Heating Piping & Air Conditioning

MAY 1956

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INDUSTRIAL • COMMERCIAL • INSTITUTIONAL • PUBLIC BUILDINGS

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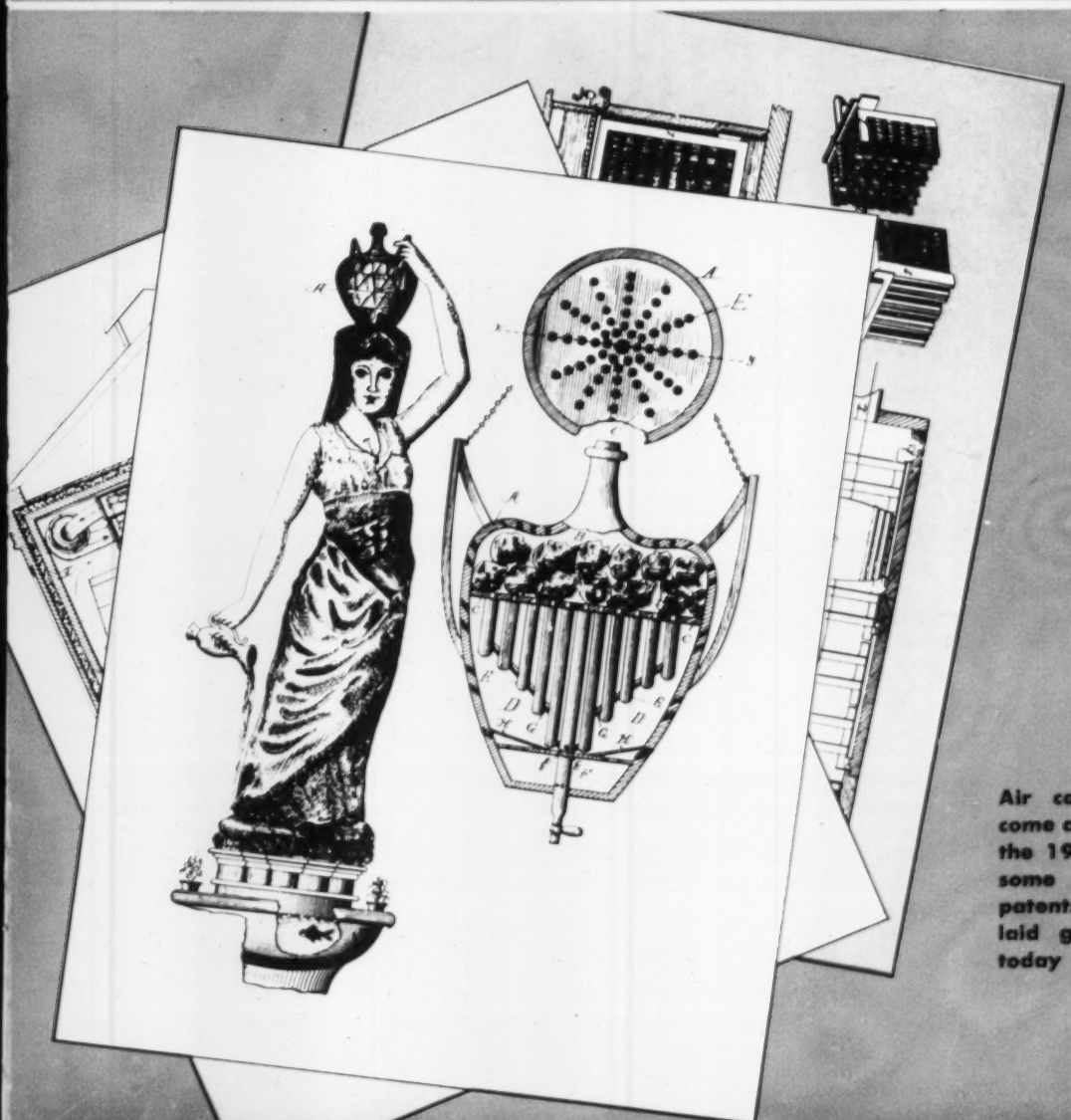
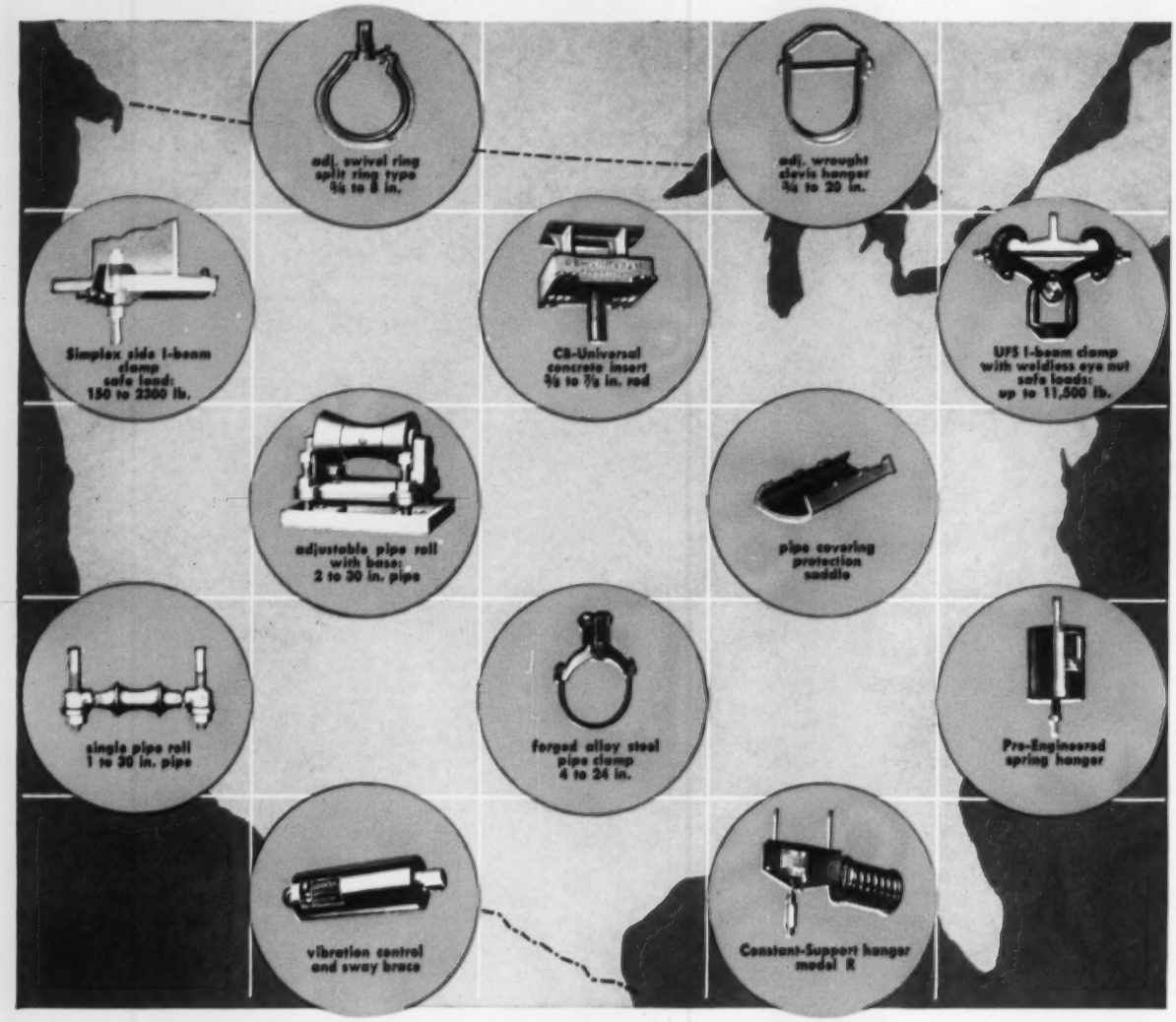


Air conditioning has come a long way since the 19th century, but some odd, amusing patents of that era laid groundwork for today . . . . . page 98

GRINNELL OFFERS YOU


adj. swivel ring split ring type ¾ to 8 in.
adj. wrought clevis hanger ¾ to 20 in.
Simplex side I-beam clamp safe load: 150 to 2300 lb.
CB-Universal concrete insert ⅜ to ⅞ in. rod
UFS I-beam clamp with weldless eye nut safe loads: up to 11,500 lb.
adjustable pipe roll with base: 2 to 30 in. pipe
pipe covering protection saddle
single pipe roll 1 to 30 in. pipe
forged alloy steel pipe clamp 4 to 24 in.
Pre-Engineered spring hanger
vibration control and sway brace
Constant-Support hanger model B

the largest line, widest distribution, finest service in

PIPE HANGERS AND SUPPORTS, ANYWHERE!

Grinnell is America's No. 1 supplier of pipe hangers and supports. There is no other company, anywhere, which provides as thorough and complete distribution service; makes as complete a line; or can cooperate as fully with you on *all* your piping assignments..

Through Grinnell's coast-to-coast system of strategically located warehouses and jobbers, for example, you can purchase Grinnell Hangers out of stock, anywhere. Moreover, Grinnell, alone, of all manufacturers, maintains a staff of trained personnel that is ready to work with you "on the job", anywhere, in solving any problem connected with erection of pipe hangers and supports. Profit by Grinnell's nationwide service, large-capacity manufacturing facilities, and practical knowledge gained during more than 100 years of service in the piping field. Next time, specify Grinnell Pipe Hangers.

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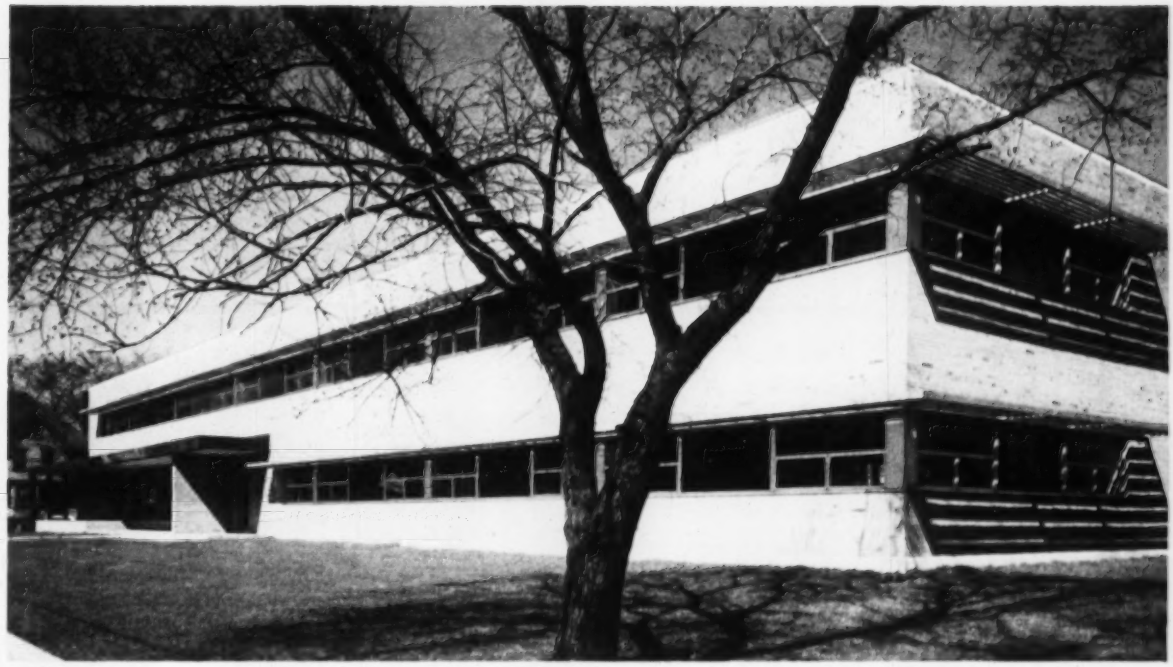
Grinnell Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems



Unusual year 'round air conditioning system uses

radiant panels plus air handling unit to effect significant operating economies

An unusual combination of air conditioning and ceiling heating and cooling coils has been installed in the new 25,000 square foot AAA Building in Kalamazoo, Michigan, headquarters building of the Detroit Automobile Inter-Insurance Exchange and the Automobile Club of Michigan. The building has 2 floors and a basement.

Providing the benefits of the two types of heating and cooling, the system uses ceiling coils to circulate hot water for winter radiant heating, chilled water for summer cooling. In conjunction with this, a 30-ton USAIRCO dual circuit self-contained central station unit (RK) provides conditioned, cooled or heated air for the two main floors. The factory balanced and tested RK, saves 95% of water consumption costs because of its built-in evaporative condenser.

The dual system provides an evenness of heating and cooling, and significant economies in operation. And in contrast to the completely radiant system, it also circulates fresh, tempered and filtered air of the right humidity throughout the offices.

In the summer, a USAIRCO 25-ton packaged chiller cools water for the radiant system. Water temperature is kept above the dew point to prevent sweating of pipe coils. In winter, hot water is similarly run through the system and to a coil in the USAIRCO RK unit to heat the conditioned air.

Architect
Louis C. Kingscotts and Associates

Mechanical Contractor
Miller-Davis Plumbing and Heating Company

Refrigeration Contractor
Tony's Refrigeration

Electrical Installation
Sanderson Electric Company

All are of Kalamazoo, Michigan

for descriptive literature on RK's write C. T. Hauckinson

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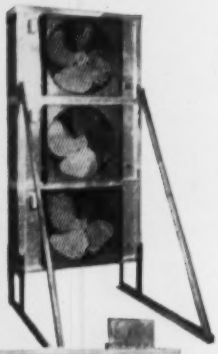
USAIRCO
30 YEARS OF AIR CONDITIONING

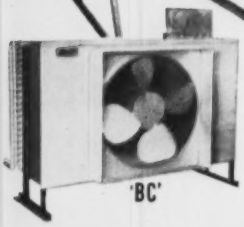
BUSH ... a SINGLE SOURCE FOR *All* YOUR WATER-SAVER NEEDS

'CDT'

'IEC'



'PFC'



'BC'

'PS'

Wherever water is scarce, expensive, or contains excessive impurities . . . or wherever disposal facilities are inadequate . . . a Bush water-saver can solve the problem. Whatever your need or preference in water-saving equipment, there's a Bush unit to meet it.

All Bush water-savers incorporate the most advanced engineering design . . . feature rugged, top quality construction.

For single-source simplicity, select BUSH. And for capable engineering or application assistance, call on the experienced Bush sales engineer in your area.

'CDT' COPPER DECK COOLING TOWERS

All copper decking cannot rust or rot. Sectional construction permits arrangement with blower fan or propeller fan . . . permits substitution of Inner-Fin coil for operation as evaporative condenser.

'PFC' PROPELLER-FAN CONDENSERS

Permit condensing of refrigerant *without use of water*. Two basic models, 2.2 Tons and 3.3 Tons, can be combined by mounting in banks to obtain any desired tonnage.

'IEC' INNER-FIN EVAP CONDENSERS

Inner-Fin coil construction, *a Bush exclusive*, permits compactness of construction impossible in other units. Can be operated DRY where conditions warrant. Can be arranged with blower fan or propeller fan . . . converted to cooling tower by substitution of copper decking for condenser coil.

'BC' BLOWER CONDENSERS

For *waterless* condensing. Available in capacities up to 20 Tons, units feature low noise level . . . *quiet* operation. Famed Inner-Fin coil construction, rugged all-steel cases with durable rust-resistant finish. Easy to install; available arranged with blower fan or propeller fan.

'PS' PRESSURE STABILIZERS

Automatically maintain satisfactory head pressure when air cooled condensers operate outside in low ambient temperatures.

Request catalogs containing complete specifications on units shown.

BUSH MANUFACTURING CO.

WEST HARTFORD 10, CONNECTICUT • RIVERSIDE, CALIFORNIA

Heating Piping & Air Conditioning

Vol. 28 No. 5

MAY 1956

(with which is merged the Aerologist)

DESIGN, INSTALLATION, OPERATION AND MAINTENANCE IN INDUSTRIAL, COMMERCIAL, INSTITUTIONAL AND PUBLIC BUILDINGS

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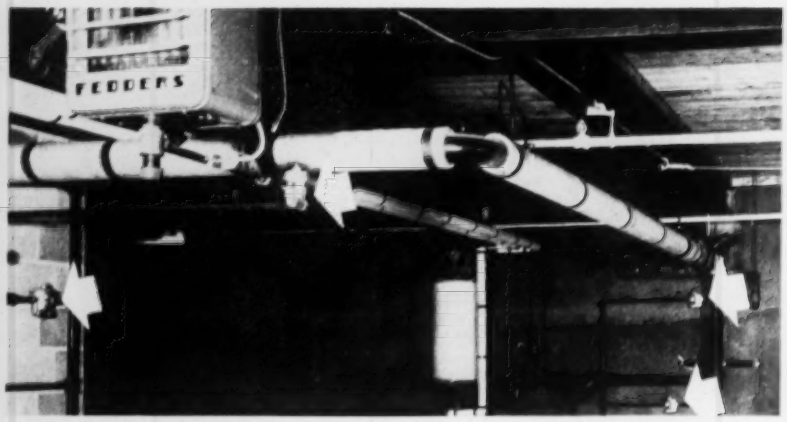
How One Company Has Saved $80,000 to Date by Buying 600 Steam Traps



Armstrong built-in strainer traps save maintenance as well as fuel at L. G. Balfour Co., Attleboro, Mass.

Joseph Brooks, Production Manager at Balfour, insists on "Armstrongs — *no substitute.*"

Armstrong Traps on Low Pressure, Vacuum Return Heating System Cut Fuel Costs $8,000 Per Year, Have Served 10 Years Without Repairs

YOU'D HAVE TO SELL a lot of fraternity pins to come out with $80,000 profit. But, that's the dollar-saving a couple of alert plant men have made by installing Armstrong steam traps at L. G. Balfour Company, fraternity jewelry makers of Attleboro, Mass. And, they've made their own jobs easier by doing it.

Just 10 years ago, Joseph Brooks, Production Manager, and C. J. Ripley, Maintenance Superintendent, installed the first Armstrong traps on their low pressure vacuum return heating system. Now they have 600 in use throughout the plant. The results have been an engineer's dream:

1. Fuel costs reduced $8,000 annually despite doubling of the factory's size and increased prices of coal.

2. One boiler did work of two after trap installation in original plant. Steam pressure was reduced from 50-75 lbs. to 22-27 lbs. Pressure is reduced to 4 lbs., with 6"-8" vacuum.

3. No trap repairs except cleaning in 10 years and no servicing of any kind where strainers were used ahead of traps. Armstrong Y-Type strainers have now been installed ahead of all No. 800 traps and all new traps are No. 880's with built-in strainer (costing less to buy and install than separate strainer and trap.)

This story of Balfour's $80,000 profit wouldn't be as significant if it were the only one of its kind. But, the frequency of such reports about Armstrong trapping establishes firmly the tremendous cost-reduction opportunities available to many plants throughout the country — perhaps to yours. Isn't it worth looking into?

Your local Armstrong Factory Representative or Distributor will survey your trapping without charge or obligation. Call him or write:

Bottom inlet and side inlet styles for all services.

ARMSTRONG MACHINE WORKS
874 Maple Street, Three Rivers, Michigan

FREE:
44-page Steam Trap Book —a complete guide to better trapping

ARMSTRONG MACHINE WORKS
874 Maple St., Three Rivers, Michigan

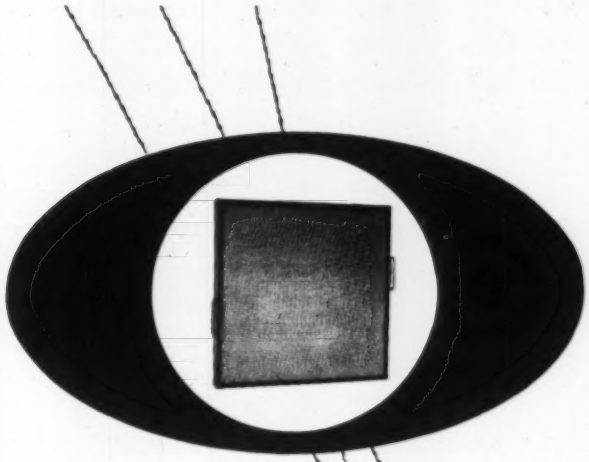
Please send me a "Steam Trap Book"

Name_____

Company_____

Street Address_____

City_____ Zone____ State_____



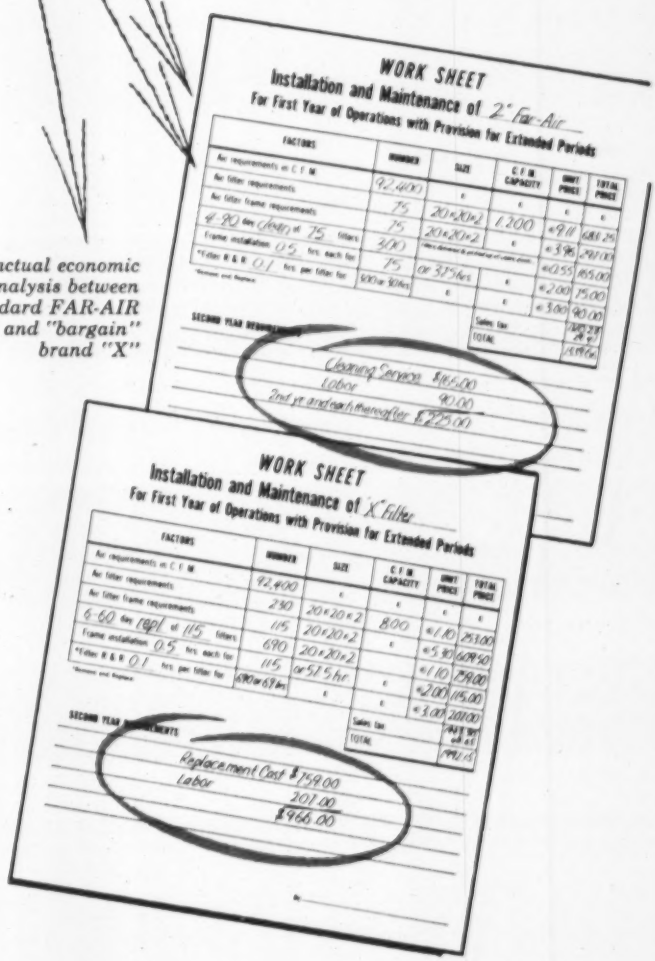
NOW—
you can be sure you are right

Because most filters are efficient at cleaning air, you are reasonably sure of getting a satisfactory job when you install an established make. The service life of your expensive air conditioning machinery and the comfort of your building depend on the ability of relatively low cost filters to do their job.

FARR Company, as one of the country's leading filter manufacturers, wants to insure that your are getting the most value out of your present filters, regardless of make. Therefore, they will send a field engineer who is an air filtration expert, to carefully analyze your air filters and submit a factual, written report like the one shown, on his findings. Often he can make suggestions that will greatly increase your filtration efficiency and save a substantial amount of money in operating costs.

FARR Company is making this service available to you on a no cost basis because it will increase your appreciation for the function of the often-neglected air filters. It will point out the importance of buying standard brand filters. It will in some cases result in sales for FAR-AIR filters . . . and that is important, too.

Why not try this service? It is factual, honest and subject to favorable comparison by any reputable manufacturer. Write today to Farr Company, P.O. Box 45187, Airport Station, Los Angeles 45, Calif.



An actual economic analysis between standard FAR-AIR filters and "bargain" brand "X"

ORIGINATORS OF FAR-AIR CERTIFIED FILTER SERVICE

FARR COMPANY

NO COMPROMISE ON QUALITY

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New Orleans

SERIES 200
New by
NEW CURVED DESIGN LOUVER
directs air right where it's needed — prevents see-thru. Solid section, all aluminum.

TITUS

Completely Adjustable

OUTLET GRILLE

FOR CEILING and SIDEWALL INSTALLATIONS

Here's the newest development for efficiently controlling the diffusion of forced air. It's the first truly "convertible" ceiling and sidewall diffusion grille . . . *THAT'S EQUALLY EFFICIENT WHEN HANDLING EITHER COOLED OR HEATED AIR.*

Greater free area and *individual louver adjustment* make this amazing performance possible.

Installation requires less labor. Requires no unhandy equipment to convert from cool to heated air. Just a simple matter of moving the louvers. Equally adaptable to old or new installations.

Mail the coupon today and learn how the new Titus "Series 200 Outlet Grilles" can *help you save money on every installation requiring sidewall or ceiling diffusion.*

New FREE CATALOG

TITUS MFG. CORP. • Waterloo, Iowa

Gentlemen: Please rush me FREE catalog on new TITUS CEILING AND SIDEWALL OUTLET GRILLES which are creating a new design trend.

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Company

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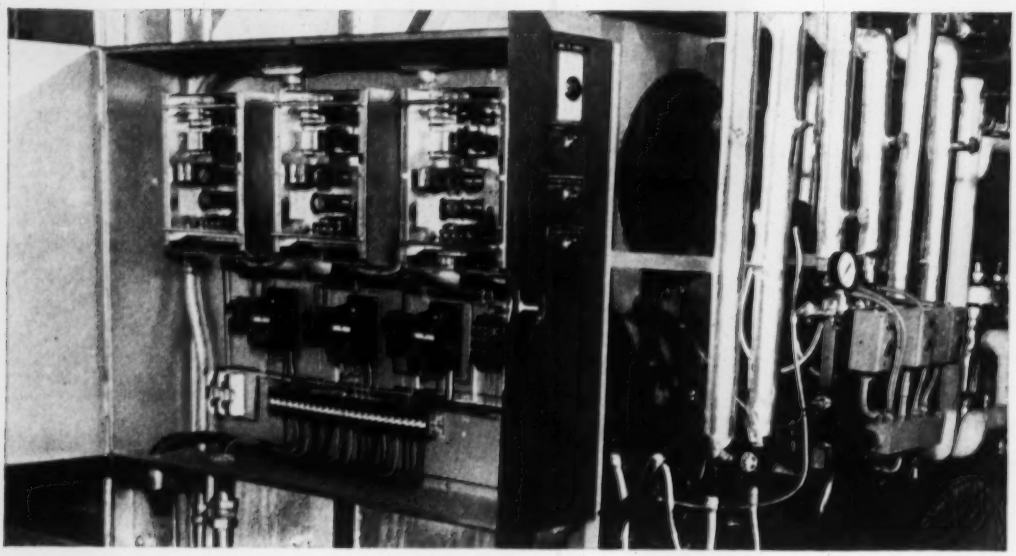
a fireye Interlock System went in AFTER THE EXPLOSION...

Back Up Your Boiler Operator with Safeguards that



How FIREYE covers every step in the firing cycle —

PREVENTS hurrying or skipping steps essential to safe operation
PREVENTS light-off until combustion chamber and passages are purged clean
BLOCKS main fuel supply until pilot is proved at the right point for light-off
SHUTS OFF fuel if main flame does not stabilize within the trial-for-ignition period
SHUTS OFF fuel and sounds alarm if the flame goes out during the firing period

THE RESULT OF 1 SLIP

IN 15 YEARS OF PERFECT PROCEDURE

Cost of new boiler — $35,000 . . .
Cost of lost production — much more

FOR 15 YEARS a well-designed boiler and an experienced and thoroughly competent operator were enough for safety in this large New England plant. Of course, there was a "standard" type of burner safeguard present as well.

THEN, came one of the slips that prove no human is infallible. The operator attempted to light off a second burner from one already firing. The "safeguard" was too slow . . . there was a flash . . . the boiler was destroyed . . . production was shut down for months.

Protect Every Stage of Light-Off and Firing

Your boiler operator knows how great the need is for an assistant like Fireye. He knows that incorrect light-off or flame failure can occur in even the most modern burner installations. He knows that operators are only human, that they can slip. He is keenly aware that in an emergency no man can always act fast enough to avert disaster.

Fireye is the proved, complete, factory-integrated system that foresees and forestalls hazards of fuel burning in multiple-burner installations. With its Firetron "eye" that constantly monitors all stages of the firing cycle, Fireye acts within 2 to 4 *seconds* of the start of trouble. Its system of timers, interlocks, and shutoff valves automatically supervises every operating step.

The Fireye organization brings to your problems a knowledge and experience in fuel burning control that is without equal. It benefits you whenever Fireye engineers, located throughout the country, come in to survey your situation . . . supervise installation of Fireye equipment . . . check out the installation, and train your operating personnel.

Fireye alone can serve you so completely — and your need for its services may be greater than you realize. Begin TODAY, by mailing the coupon for your copy of a non-technical bulletin that explains why most fuel-burner explosions happen, and how Fireye prevents them.

E C A fireye

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Protect Your Boiler NOW — send for this

COMBUSTION CONTROL DIVISION • ELECTRONICS CORPORATION OF AMERICA
Dept. C13-5, 718 Beacon Street, Boston, Mass.
In Canada, write Electronics Corporation of America (Canada) Limited, Box 111, 98 Advance Road, Toronto 18.

Send Bulletin CP21 on Flame Failure Explosions

NAME _____

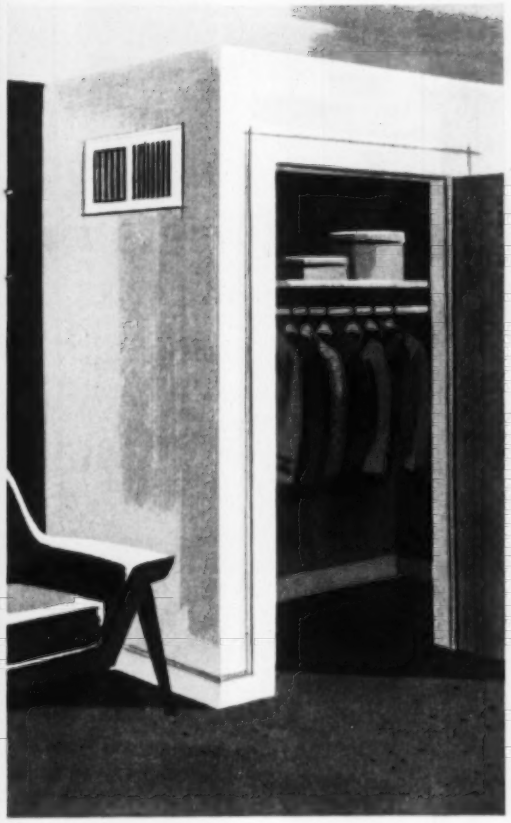
FIRM _____

ADDRESS _____

Carrier again makes news

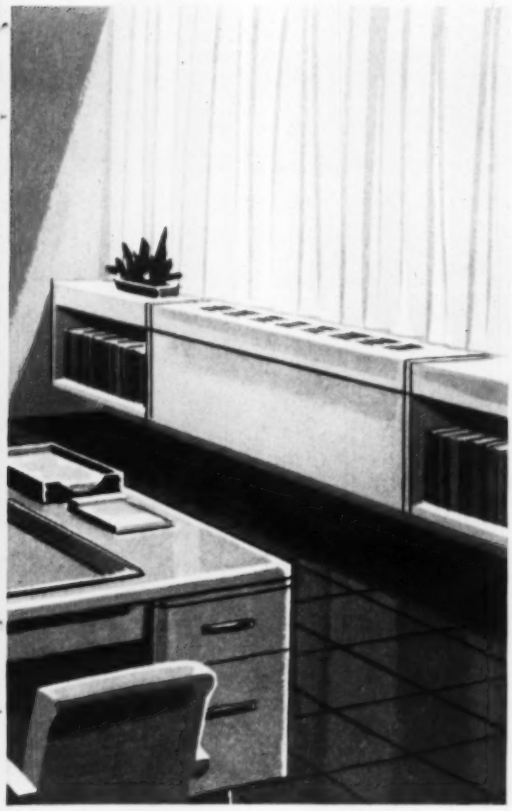
▼ *Carrier's New Room Weathermaker*

New Carrier Weathermaker ▲



▲ *Carrier's New Unit Weathermaker*

New Carrier Modular Weathermaster Room Unit ▼



Here are the newest ways to air condition an apartment building, a hospital, a hotel, a motel, an office building

The four Carrier units you see here have one thing in common—they're brand new!

They open up a good many interesting design and application possibilities in the jobs you're just starting.

They may even suggest compelling changes in plans you've virtually completed.

The New Carrier Weathermaker* (top left) is the one self-contained air conditioner designed for lower installation costs. It requires less space and permits more freedom in the location of the unit, singly or as part of a multiple unit system. Can be installed with or without ductwork, built in the wall, or located completely in the room.

Carrier's New Room Weathermaker (bottom left) is an extremely flexible fan-coil unit. It can be mounted horizontally or vertically, with or without cabinet. Put it on the ceiling or stand it on the floor anywhere in the room. Attach it to a wall. Fur it in. Or recess it under a window. Three sizes—½, 1, 1½ tons. For chilled or hot water, or direct expansion. Provides individual control of summer cooling or winter heating.

Carrier's New Unit Weathermaker (top right) is a fan-coil unit designed for overhead installation. It installs easily in the top of a closet, over a corridor or hallway, or behind a wall. Three sizes—½, ¾, 1 ton. For chilled or hot water, or direct expansion. Provides individual control of summer cooling or winter heating.

The New Carrier Modular Weathermaster* Units (bottom right) bring a new flexibility to the world's finest air conditioning—the Carrier Weathermaster System. The new under-the-window units with their modular components fit into a variety of combinations—decorative ledges, built-in cabinets and modern bookcases. Now it's easy to make air conditioning part of interior design.

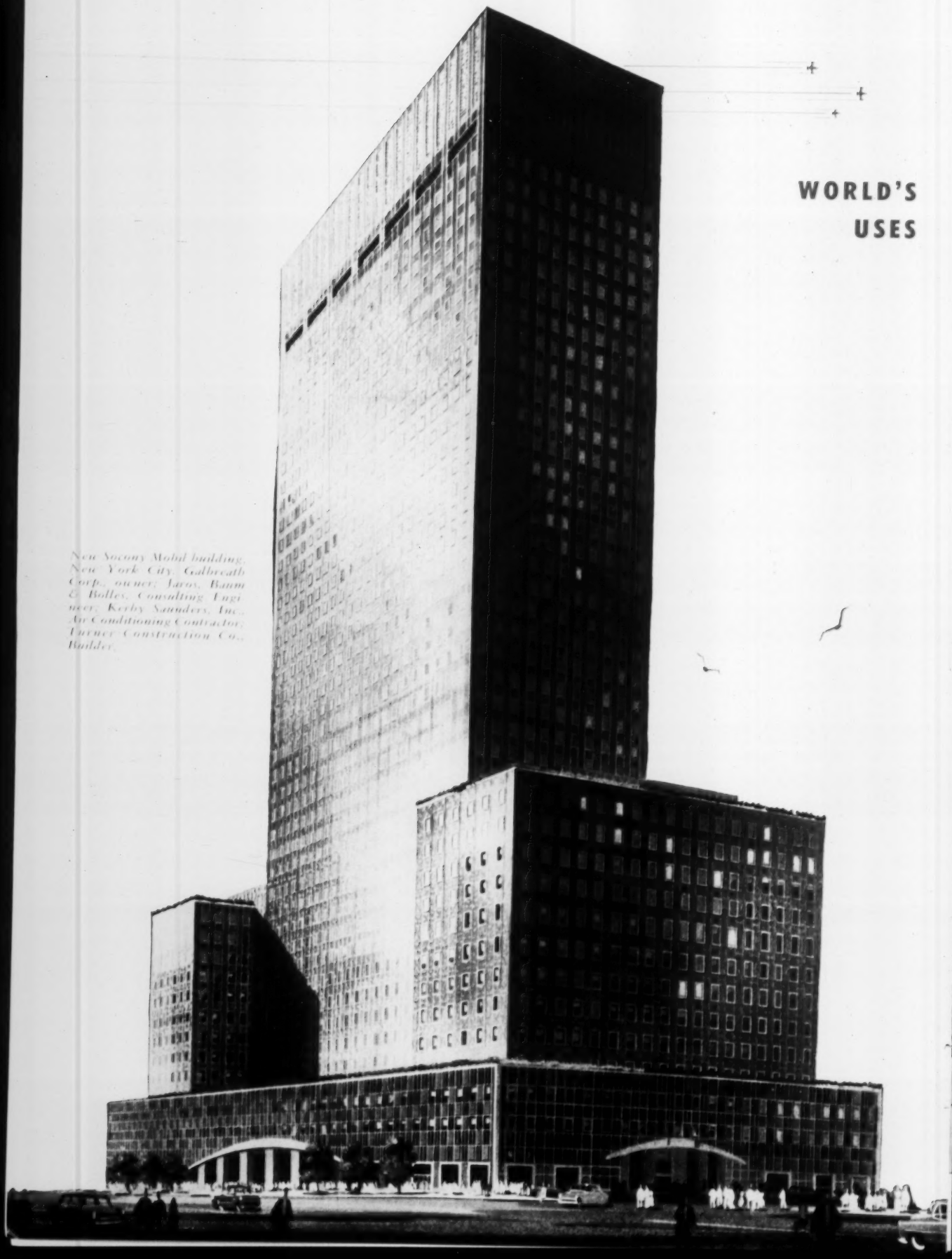
Carrier has *all* ways to air condition *any* job—and all Carrier equipment is engineered to the same uniform standard. So short-cut hours of selection by (1) using the Carrier line as a shopping guide and then (2) comparing values. Get in touch with your Carrier dealer or branch office. They're listed in your Classified Telephone Directory. Carrier Corporation, Syracuse, New York.

*Reg. U. S. Pat. Off.

Carrier

air conditioning
refrigeration
industrial heating

WORLD'S
USES



New Socony Mobil building, New York City. Galbreath Corp., owner; Jaros, Baum & Bolles, Consulting Engineer; Kerby Saunders, Inc., Air Conditioning Contractor; Turner Construction Co., Builder.

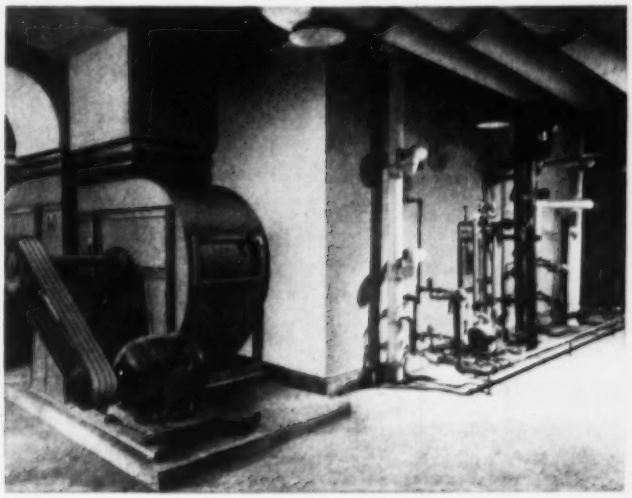
LARGEST AIR CONDITIONED COMMERCIAL OFFICE BUILDING
75 FANS, 22 CONDITIONING UNITS BY "BUFFALO"

A new landmark at Lexington and 42nd St., New York, the Socony Mobil building is a model for office buildings of the future. It is the largest fully air conditioned commercial office building in the world — the largest built in New York in a quarter-century. Offering so much to tenants, it is little wonder that its 1,300,000 square feet were virtually 100% rented before completion.

Selection of "Buffalo" for all the fans and many of the conditioning units reflects the confidence which engineers, owners and contractors have placed in "Buffalo" for the past 79 years. You will find "Buffalo" air handling equipment in outstanding plants, hotels, institutions, stores and public buildings throughout this hemisphere. And everywhere, you will find it performing to satisfaction, because "Buffalo" builds the "Q" Factor* of Quality into every unit. If you have a job for air, write "Buffalo" into the plans to insure the results you want.

"Buffalo" Type BL Fans handle air in Socony Mobil building. These fans (some of them 13 feet high) plus "Buffalo" Axial Flow Fans and "Buffalo" Shorthoy Ventilation Units move all the air. PCLW Dehumidifiers, Humidifiers and PC Air Conditioning Cabinets process the air for various zones.

2 of 4 "Buffalo" PC Comfort Conditioning Cabinets providing controlled climate for certain areas of Socony Mobil building. These horizontal models may be suspended as shown, saving space. The two units not shown are vertical models. All are of "Q" Factor construction, including built-in "Buffalo" Fans, "Buffalo" Pumps, Aerofin coils and heavy-gauge paneling.



**The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.*

BUFFALO FORGE COMPANY

BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

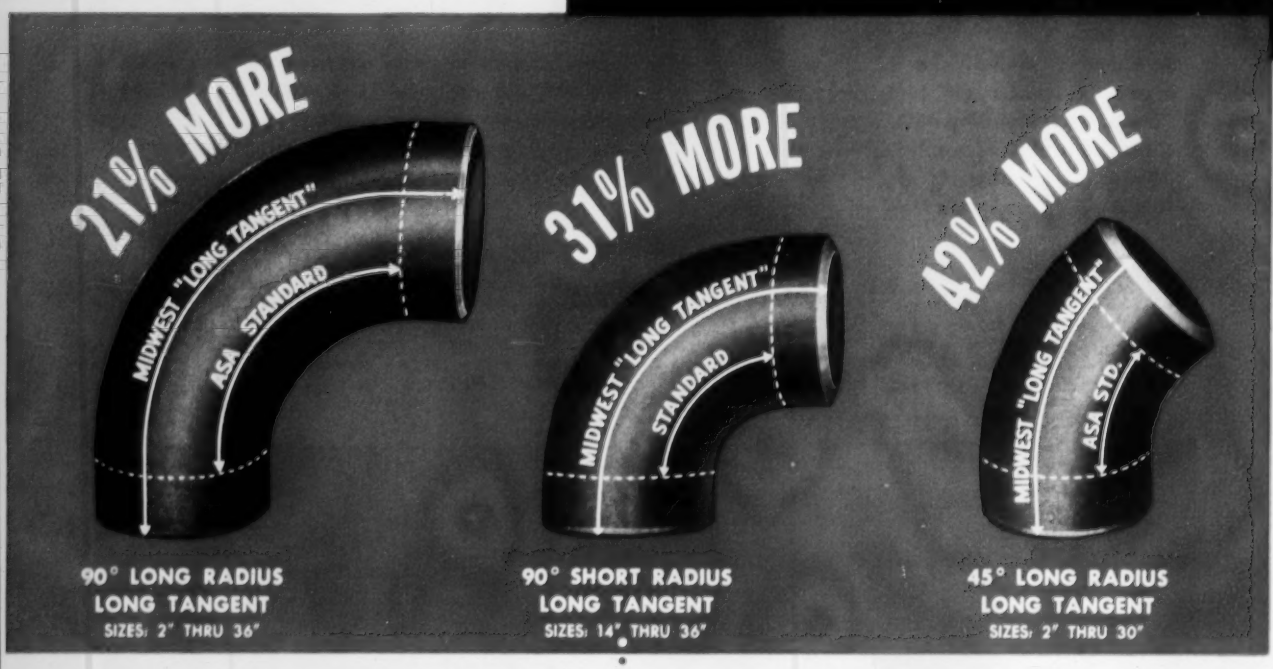
VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING

. . . you get

21% to 42% MORE ELBOW

for the same cost

When You Use MIDWEST "LONG TANGENT" ELBOWS



90° LONG RADIUS
LONG TANGENT
SIZES: 2" THRU 36"

90° SHORT RADIUS
LONG TANGENT
SIZES: 14" THRU 36"

45° LONG RADIUS
LONG TANGENT
SIZES: 2" THRU 30"

ADVANTAGES OF MIDWEST "LONG TANGENT" ELBOWS

- ★ They save pipe.
- ★ They often eliminate short nipples and their extra welds.
- ★ They save time and money in lining up and clamping pipe and fitting.
- ★ They make it easier to apply slip-on flanges.
- ★ They remove the circumferential weld from point of maximum stress and can be sleeved.
- ★ THEY COST NO MORE THAN OTHER ELBOWS.

The long tangents available *only* on Midwest Welding Elbows give you *more fitting for the same price* . . . Midwest "Long Tangent" Elbows cost no more than other elbows. This added length has numerous advantages for the user of welded piping . . . advantages that save money and improve piping. For all the facts, ask the nearest Midwest distributor or write us for Catalog 54.

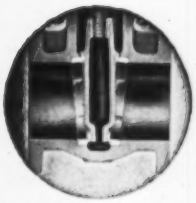
MIDWEST PIPING COMPANY, INC.

Main Office: 1450 South Second Street, St. Louis 4, Mo.
Plants: St. Louis, Clifton, N. J. and Los Angeles

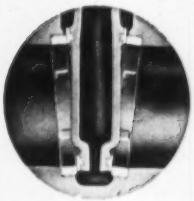
Sales Offices:
New York 7—50 Church St. • Chicago 3—79 West Monroe St.
Cleveland 14—616 St. Clair Ave. • Los Angeles 33—520 Anderson St.
Houston 2—1213 Capitol Ave. • Tulsa 3—224 Wright Bldg. • Miami 34—2103 Le Jeune Rd. • Boston 27—426 First St.
STOCKING DISTRIBUTORS IN PRINCIPAL CITIES

MIDWEST WELDING FITTINGS IMPROVE PIPING DESIGN AND REDUCE COSTS

7324

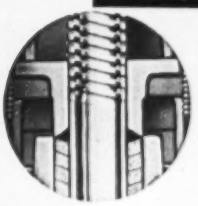


Straight-Flow Port Design reduces fluid turbulence to a practical minimum.



Seat Rings of end-seated type are screwed into the body.

Sure-Grip Malleable Handwheel for non-skid gripping even with heavy gloves.

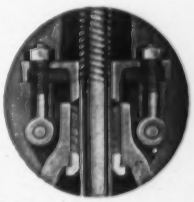


Brass Liner on Glands assures greater resistance to corrosion and scoring.

T-head Disc-to-Stem connection on OS&Y types provides stronger connection, prevents loosening of disc by corrosion.

Bronze Back-Seat Bushings in bonnets of OS&Y valves.

Solid Web Type Disc in OS&Y valves for greater strength and longer service.



Hinged Gland Eye-Bolts on OS&Y valves permit faster, easier repacking under full pressure.

WALWORTH

iron body gate valves

with screwed or flanged ends

... 8 Outstanding Features

For complete information on these new Walworth Iron Body Valves, see your local Walworth distributor, or write for bulletin 106.

WALWORTH

valves and fittings

60 EAST 42nd STREET NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

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DIVISION OF AMERICAN AIR FILTER
50 YEARS OF QUALITY

HERMAN NELSON

A Name Known For *Better Air* throughout half a century

OLD ENOUGH to have built a reputation for quality and dependability throughout half a century.

YOUNG ENOUGH to be continually in the foreground with the newest developments in heating, cooling and ventilation.

BIG ENOUGH to offer one of the most complete lines in the industry, and a nation-wide service organization second to none.

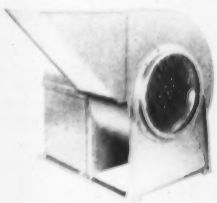
SMALL ENOUGH to give every customer the prompt personal attention and service that his order requires.

HORIZONTAL UNIT HEATER

Available in 18 sizes, designed for ceiling suspension and also to use either steam or hot water. Quiet operation; compact design. Catalog No. 700.

INDUSTRIAL HEATER

Replaces exhausted air, balances minus pressures. Big capacity—does the job of many smaller, propeller-type units. Catalog No. 750.



UNIT BLOWER

Years-ahead features in new "packaged" Unit Blowers. Compact, space-saving, easy to service. Wide range of unit sizes. Catalog No. 826.

A wealth of useful data now ready for you in the NEW HERMAN NELSON Catalogs

New, modern format . . . easy-to-read engineering catalogs that are the finest in the industry are yours for the asking. Request catalogs you need on your business letterhead. Address American Air Filter Co., Inc., 373 Central Ave., Louisville 8, Ky.

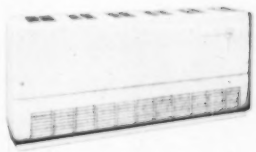
Heating and Ventilating Products

VERTICAL UNIT HEATER

For high ceiling installations. Discharges air vertically downward or at angle to vertical in various directions. Steam or hot water. Catalog No. 700.

GAS-FIRED UNIT HEATER

Job-rated for stores, lobbies, studios, warehouses, offices, salesrooms—all efficient heating. Available in seven different sizes. Catalog No. 715.

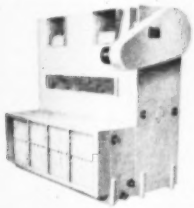


CONSOLE HEATER

16 models—64 air inlet-outlet arrangements. Fully recessed, semi-recessed or free-standing applications. Smartly designed. Catalog No. 727.

HEATING & VENTILATING UNIT

Hangs on ceiling, out of the way, or mounts on wall or floor. Quiet operation, slow speed, with completely rotatable fan sections. Catalog No. 775.

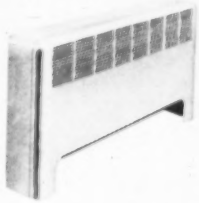


AIR CONDITIONING UNIT

New type air-conditioning units for low cost commercial and industrial applications. Delivers up to 15,000 cu. ft. clean, cooled air per minute. Catalog No. 785.

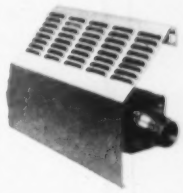
CLASSROOM UNIT VENTILATOR

Functional, trim, clean lines—the modern version of the unit classroom heater and ventilator. Efficient, functional in design, attractive. Catalog No. 3500.



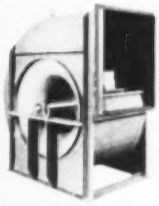
CONVECTOR

Free standing or semi-recessed models in 4 depths and 3 or 4 heights. Can be furnished with dampers. Steam or hot water. Catalog No. 791.



FINNED RADIATION

Available either with steel fins on steel tubing or aluminum fins on copper tubing. Light weight, suitable for exposed or concealed installation. Catalog No. 790.



CENTRIFUGAL FAN

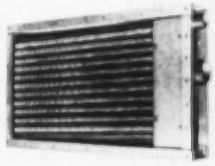
Available in either slow speed or non-overloading types, 17 wheel diameters from 12¼" to 73"; 8 arrangements for direct or belt drive. Catalog No. 850.

INDUSTRIAL EXHAUSTER

Exclusive hub assembly cuts maintenance & replacement costs. New impeller design; heavy duty shaft & bearings. Catalog No. 860.

PROPELLER FAN

Operates horizontally or vertically; belt or direct drive. Wide range of sizes in both types. Capacities to 36,150 CFM. Low operating cost. Catalog No. 800.



AEROFIN COILS

A complete line of steam, hot water, chilled water, direct expansion and special duty coils. Catalog No. 49-98.

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AAF

herman nelson

American Air Filter

COMPANY, INC.

General Offices: Louisville, Kentucky

Plants in Louisville, Moline (Ill.), Morrison (Ill.), Chicago and Montreal (Canada)

ALCO SOLENOID VALVES

...packless, tight-seating

Users like the positive, automatic shut-off of Alco Solenoids. They are precision controls manufactured for refrigerant flow. Coils are moisture-proof, extra powerful and wound for long life.

Alco Solenoids may be installed in remote locations and operated by any electrical control. For all types of refrigerant service—liquid, suction or hot gas discharge... and for brine, water, steam and air.

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Write for Condensed Catalog 20 and technical bulletins 173 and 182.

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ALCO VALVE CO.

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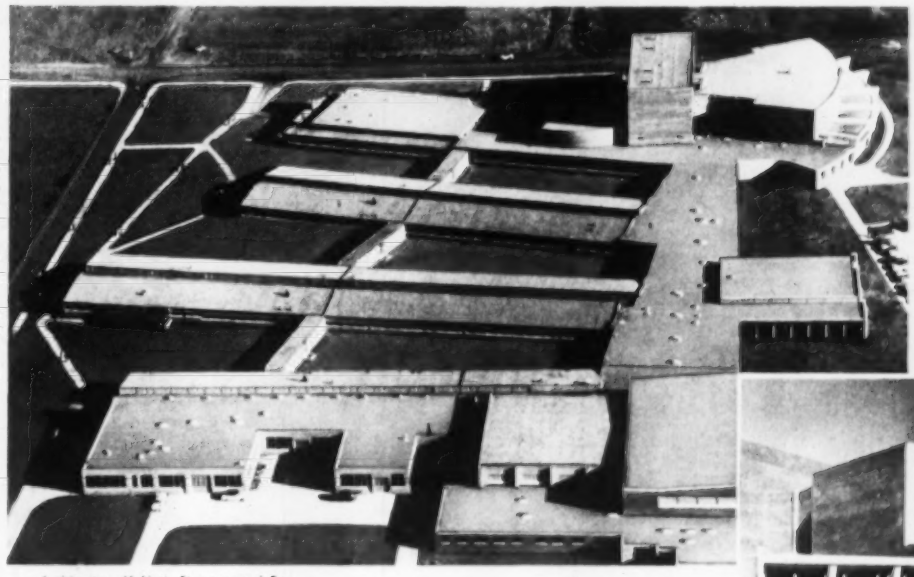
Designers and Manufacturers of Thermostatic Expansion Valves; Evaporator Pressure Regulators; Solenoid Valves; Float Valves; Float Switches.

6315

77 Gallaher Air-Vans®

provide *quiet* efficient ventilation

for this $2,500,000 school



$2,500,000 Grand Island High School. A model building of efficiency and beauty.

Architects: McNett, Stanage and Co.
General Contractor: Holtz Construction Co.
Heating and Ventilating: J. M. Lingeman Co.

The modern entrance to Grand Island High School.

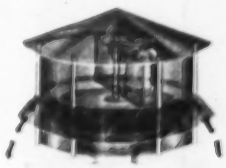
77 rugged Air-Vans solve the many ventilation requirements of this new, modern, high school at Grand Island, Nebraska. But most important, Air-Vans meet the demand for the quiet operation that the atmosphere of a school demands.

Research-designed Air-Vans meet this problem in every respect, because the problem of noise in exhauster design has been carefully analyzed. Special vibration isolators are built in. Air flow has been streamlined so that noise, caused by turbulence, is eliminated.

Top efficiency is reached because Gallaher Air-Vans have the exclusive patented scroll design that guarantees high performance against static pressures up to 4". Appearance and silhouette are unobtrusive and complimentary to the building.

This is just one of the thousands of public or industrial buildings where Gallaher Air-Vans have been specified. Air-Vans have the features that count—rugged construction, weatherproof design, a safe fume handling system, availability in special metals, certified ratings and shipment-to-site ready to install.

Direct Drive
150-11,000 CFM.
S.P. to 4.2"



11
5,000-65,000 CFM.
S.P. to 4".

Patents
2188741—2526290
Patents pending

For full information on Air-Vans write to

The GALLAHER *Company*

4108 Dodge St. **Omaha, Nebraska**

EXPORT OFFICE: 306 PAUL BUILDING, UTICA, N.Y.

Published in the interest of the Soft Drink Canners Association and the canning industry.

No headaches in these drinks!

Eliminate the hazard of broken bottles in your plant by providing your employees the safety and convenience of canned soft drinks.

Call your soft drink supplier and learn the many advantages of dispensing drinks the modern way—in cans.

Above are illustrated two of the modern cans for soft drinks, now available for in-plant use.

THE YOUNGSTOWN SHEET AND TUBE COMPANY

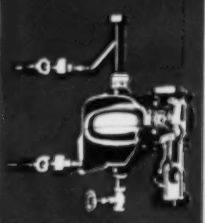
Manufacturers of Carbon, Alloy and Yoloy Steel

General Offices Youngstown, Ohio District Sales Offices in Principal Cities.

SHEETS - STRIP - PLATES - STANDARD PIPE - LINE PIPE - OIL COUNTRY TUBULAR GOODS - CONDUIT AND EMT - MECHANICAL TUBING - COLD FINISHED BARS - HOT ROLLED BARS - WIRE - HOT ROLLED RODS - COKE TIN PLATE - ELECTROLYTIC TIN PLATE - BLACK PLATE - RAILROAD TRACK SPIKES - MINE ROOF BOLTS

No. 47 Boiler Water Feeder for hand-fired steam boilers up to 5000 sq. ft.

No. 47-2 Feeder Cut-off Combination for automatically-fired steam heating boilers up to 5000 sq. ft.



No. 147 Boiler Water Feeder — Like No. 47 but with higher feeding level for small process boilers.

No. 247-2—Feeder Cut-off Combination for small hot water space heating boilers.

No. 51-2 Feeder Cut-off Combination for automatically-fired heating boilers over 5000 sq. ft.

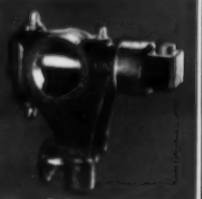
No. 53-2 Feeder Cut-off Combination — Like No. 51-2 but for higher pressures up to 75 lbs.

No. 67 Low Water Fuel Cut-off for low pressure automatically-fired steam boilers.

No. 63 Low Water Fuel Cut-off for hot water space heating boilers up to 50 lbs. pressure.

No. 69 "Built-in" Low Water Cut-off. One of many "built-ins" for installation in tapping provided in modern boilers.

No. 61 Low Water Fuel Cut-off for 1" equalizing pipe installation on low pressure steam boilers.



No. 767 Low Water Fuel Cut-off (with No. 14 blow-off) for installation in boiler opening.

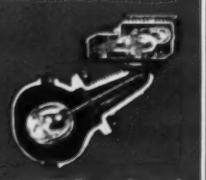
No. 101 Electric Water Feeder — Operated by McDonnell two-switch cut-offs or liquid level switches.

How many of these McDONNELL products do you know?

Check them over. You'll find a number of products you know well—but you'll also find many to solve those special problems that come up calling for liquid level controls, flow switches, and related equipment. It will pay you to know these and other products in the McDonnell FULL LINE. Ask for complete information.

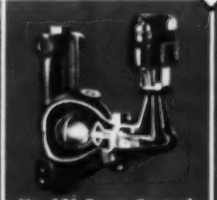
McDONNELL & MILLER, *Inc.* 3500 N. Spaulding Ave., Chicago 18, Illinois

Doing One Thing Well



No. 150 Pump Control, Cut-off and Alarm Switch for boilers of any size up to 150 lbs. pressure.

No. 157 Pump Control, Cut-off and Alarm — Like No. 150 but with integral water column.



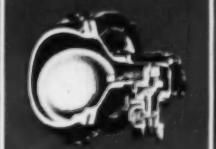
No. 191 Pump Control, Cut-off and Alarm — New magnetic repulsion switching type for boilers of any size up to 150 lbs. pressure.

No. 92 Pump Control, Cut-off and Alarm — new magnetic repulsion switching type for pressures up to 250 lbs.

No. 192 Pump Control, Cut-off and Alarm — Like No. 92 but with integral water column.

No. 21 Make-up Water Feeder for maintaining water level in receiving tanks — typical of series with flanges to fit existing tank openings.

No. 355 Large Capacity Float Valve — many uses on tanks, stills, receivers, etc.



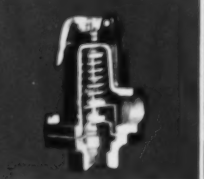
No. 4155 Feed Water Controller for multiple boiler jobs to divert pump discharge into proper boiler.

No. 65 Explosion-proof Electric Controller Underwriter's approved for hazardous locations.

No. 18 Float Valve for maintaining water level in humidifier pans, etc. Also available with float chamber as No. 518.

No. 80 Float Switch, three-wire high- or low-level alarm (or pump control) on oil storage tanks.

No. 27 Make-up Water Feeder for external application on receiving tanks.



230 Series (ASME) Pressure Relief Valves for hot water boilers, tanks and heaters.

No. 230 M-2 (ASME) Progressive settings pressure relief valves for large hot water space heating boilers.

No. 201 Temperature Relief Valve for hot water tanks and heaters. A.G.A. tested, rated and listed.

202 Series Automatic Reseating Pressure and Temperature Relief Valves. ASME (ASME) A.G.A.

No. L-8 Constant Level Valve. Maintains constant pressure of fuel oil on oil burner.

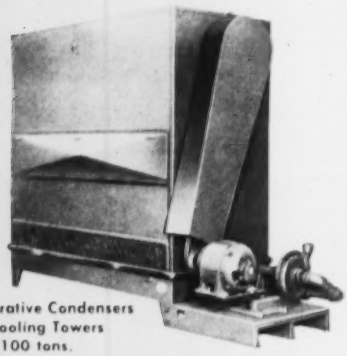
No. E-2 Flow Switch — completes (or breaks) circuit when flow starts or stops.

3 FACTUAL reasons *why* Curtis *dealers can make more money— CONSISTENTLY:*

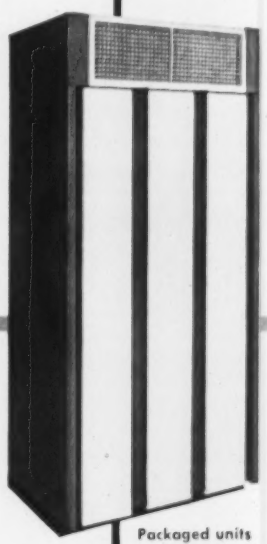
1 CURTIS has 102 years of experience in manufacturing precision made equipment. One of the first manufacturers of packaged air conditioning units—since 1936.

2 Unsurpassed know-how for building air conditioning units that operate longer with less maintenance and service—YET ARE COMPETITIVELY PRICED with generous profit margin for you.

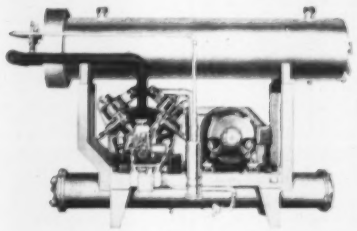
3 CURTIS provides sales and promotional aids—a complete financing plan—and a national advertising campaign to make your selling easier.



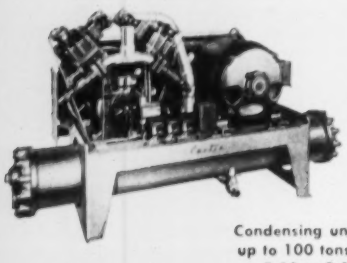
Evaporative Condensers and Cooling Towers up to 100 tons. Air handling units to match.



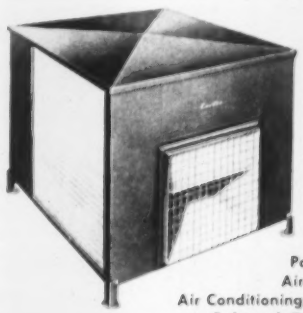
Packaged units in a rainbow of colors— a CURTIS exclusive. 3 through 50 tons.



Packaged Liquid Chillers— 7½ to 100 tons—F-12 or F-22. With room console units to provide controlled cooling and heating without duct work.



Condensing units up to 100 tons— F-12 or F-22.

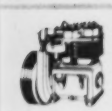


Packaged Air Cooled Air Conditioning Units— 2 through 7½ tons. Residential and Commercial applications.

Remember **YOU CAN COUNT ON** **Curtis**

MANUFACTURING COMPANY

REFRIGERATION DIVISION • 1950 Kienlen Ave., St. Louis 20, Mo.



INDUSTRIAL AIR COMPRESSORS

AUTO LIFTS

AIR CYLINDERS

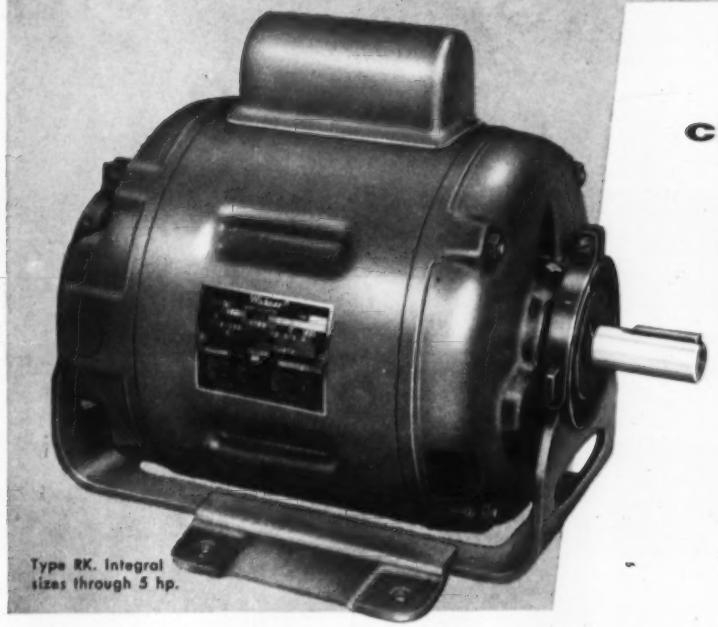
CAR WASHERS

AUTOMOTIVE AIR COMPRESSORS

1854 - 1956 our 102ND year OF SUCCESSFUL MANUFACTURING EXPERIENCE

CM-11

WAGNER ELECTRIC MOTORS...THE CHOICE OF LEADERS IN INDUSTRY



Type RK. Integral sizes through 5 hp.

choose these smaller, lighter, motors... for modern equipment

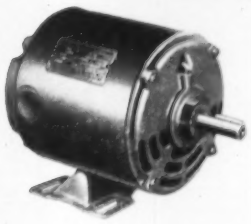
For years Wagner motors have been the first choice of many leading manufacturers of air conditioners, refrigerators, freezers, water pumps and motor-driven tools. They meet the requirements of many other similar applications because of their high starting torque and low starting current.

Now these Wagner motors are lighter in weight and smaller in size. This means that you can design smaller motor housings—build lighter motor mountings. Wagner motors are easier to handle and easier to stock because they take up less space.

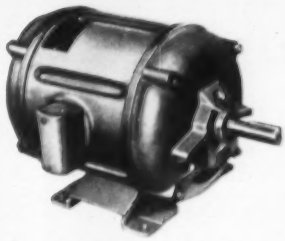
And these motors offer low maintenance costs—only a minimum of servicing is required—they give many years of reliable service with unusual freedom from vibration and noise.

Available in repulsion-start or capacitor-start types—open or totally-enclosed—sleeve or ball bearing—with rigid or resilient bases or machined endplates for flange mounting. Write today for Bulletin MU-185 which gives complete information.

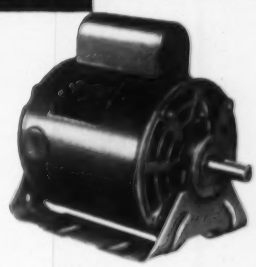
A Complete Line—Single-phase and Polyphase Motors



Type RP, Polyphase fractional horsepower motors. Available in 1/6, 1/4, 1/3, 1/2, and 3/4 hp ratings. Rigid or resilient base—sleeve or ball bearing.



Type RA, Repulsion-start induction-run single-phase motors. For applications requiring high starting torque. 1/2 to 15 hp.



Type RK Capacitor-start. 1/3, 1/2, and 3/4 hp . . . sleeve or ball bearings. The resilient mounting offers unusual freedom from vibration and noise.

Wagner Electric Corporation
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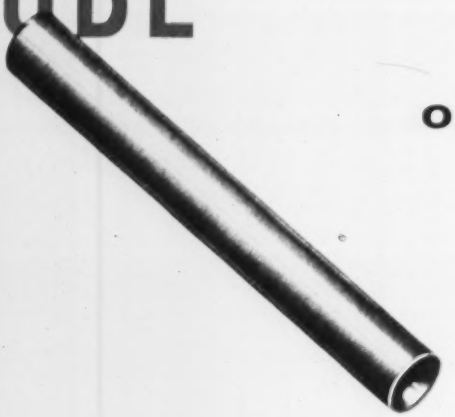

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TUBING—You can use Wolverine *drawn* aluminum tube where close tolerances and high physical properties are required. And you can save money with Wolverine *as-extruded* tube for most applications where tolerances are not as critical. Both are available in straight lengths, coils, and extra-long coils.

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ASSURED FOR N.Y. STATE THRUWAY!

FIRST... By Sarcotherm Weather-Compensated Control Systems for all 40 Toll Interchanges

AND NOW... By Sarco Heating Specialties for 23 Service Areas

ON THE NEW YORK STATE THRUWAY, there are now 23 restaurant-gas service areas and 40 toll interchanges along the 427 miles of this great vehicular artery...from New York to Buffalo.

Each of these service areas and toll interchanges has its own heating plant. Therefore, dependability of equipment is of vital importance...for faulty operation or breakdowns would mean heating headaches and call-backs all along 427 miles of highway.

That is one of the principal reasons for the installation of Sarcotherm Weather-Compensated Control Systems for the hot water heating of *all* 40 toll interchanges...and of Sarco Steam Heating Specialties for *all* the 23 service areas now completed.

For undivided responsibility on your installations, specify and order from one "Complete Line" source...SARCO-SARCOTHERM...heating specialties, temperature regulators, condensate and vacuum pumps, finned tube radiation, and weather-compensated control systems for steam and hot water heating. Write for catalogs.

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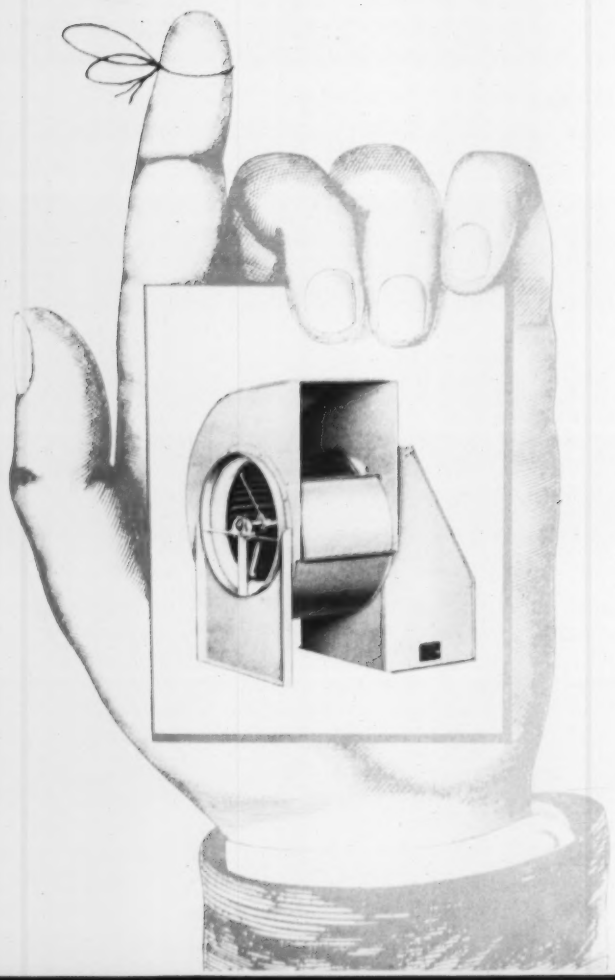
S144-B

we remembered "the forgotten fan"



High on a windy roof, "the forgotten fan" takes a year-round heavyweight beating from wind and the weather . . . frequently breaks down due to lubrication neglect. In times gone by, expensive repair or replacement was the only answer.

That was yesterday. Today, Utility has available a full series of sensibly engineered Enclosed Drive Blowers designed for outdoor service. All motors and drives are completely enclosed to seal them forever against dirt and moisture, protect them forever against drastic temperature changes. Lubricated for life with pre-greased, permanently sealed ball bearings, costly breakdowns from lack of proper maintenance just don't happen!

Next project, why not specify a Utility Enclosed Drive Blower for roof installation tailored to the job? They cost no more and save expensive and cumbersome sheet metal work. You'll find that however tough "topside" the going gets, Utility blowers can take it — day in, day out — year after faithful year.

A DIVISION OF UTILITY APPLIANCE CORP.

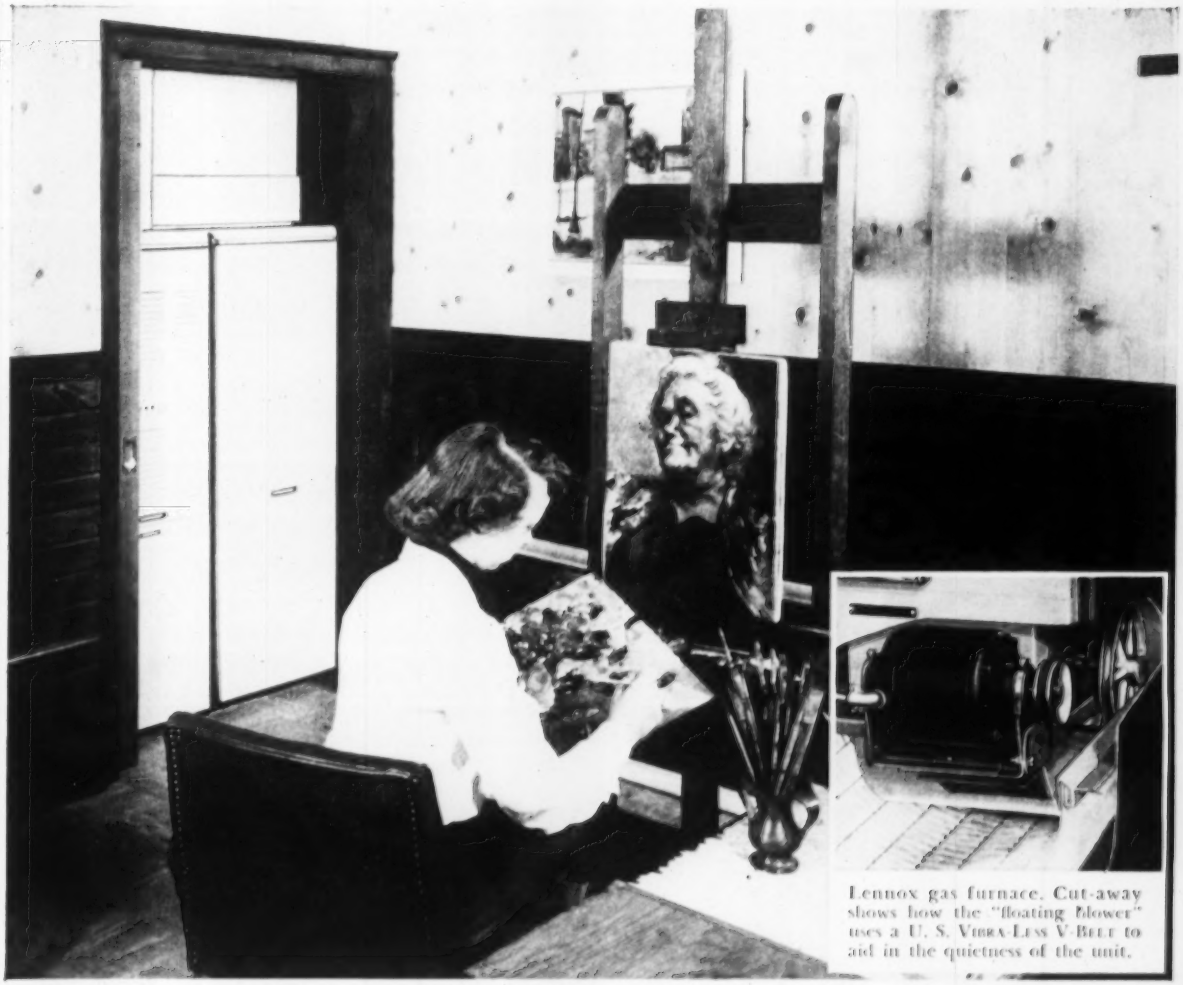
UTILITY FAN CORP.

911 East 59th Street, Los Angeles 1, California

Manufacturers of heavy and standard duty blowers for heating, air conditioning and ventilating installations. Producers of blowers and blower parts for original equipment manufacturers. Write for catalogue data.

US RUBBER Vibra-Less V-Belts

selected by Lennox engineers for quiet operation



Lennox gas furnace. Cut-away shows how the "floating blower" uses a U. S. VIBRA-LESS V-BELT to aid in the quietness of the unit.

In the Lennox gas furnace, all vibrations are stopped dead. And because vibrations cannot possibly travel on, there's no chance of noise or rattle, not even a whisper.

The U. S. VIBRA-LESS V-BELT is a big reason.

This belt has two exclusive "U. S." developments—Electronic Tension and a new kind of molding process.

With the Electronic Tension technique each cord in the belt is built in by error-proof electronics, instead of by mechanical means. This guarantees every cord will pull its full share of the load. Belt life is prolonged.

The new molding method provides a smooth contact jacket without high spots or surface imperfections . . . making U. S. VIBRA-LESS V-BELTS ideal for appliances and high-precision machinery. It also gives U. S. VIBRA-LESS V-BELTS outstanding resistance to wear, grime and moisture penetration.

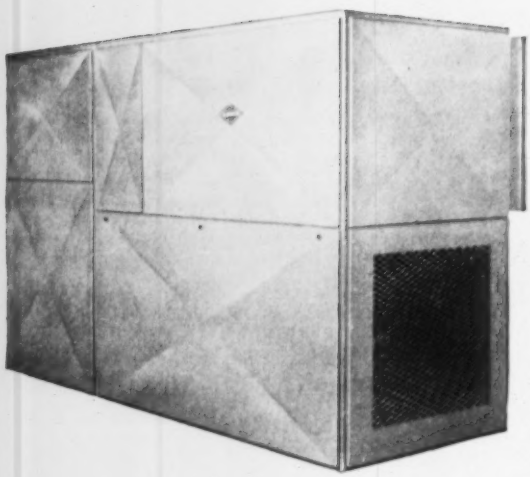
Additional information on the U. S. VIBRA-LESS V-BELT may be obtained from any of the 28 "U. S." Sales Offices or from any of the select "U. S." Distributors. Or contact us at Rockefeller Center, New York 20, N. Y.

US RUBBER Mechanical Goods Division

United States Rubber

• • • One of the nation's largest grocery chains, this Wrigley outlet in Detroit is cooled by the UNARCO AEC.

today's stores need BETTER than adequate AIR CONDITIONING



The purveying of meat, produce and groceries in today's giant supermarkets is big business. Business so important that it's poor judgment not to utilize the best air conditioning equipment available. For air conditioning has a direct effect on the quality of a store's perishables ...on a store's customers...and on employee morale.

Model AECR shown to the left represents the ultimate in air conditioning equipment. This unit, of single-cabinet construction, functions as a complete air conditioning unit, including heating if desired. It is equipped with built-in, specially designed evaporative condenser for minimum water consumption. (Where water-cooled condenser is desired, specify Model SCR.) A full range of capacities from 7½ through 60 tons makes this the ideal conditioning unit for stores, large offices and industrial installations. For a detailed brochure, write the Heating and Cooling Division, Dept. 100B.

UNION ASBESTOS & RUBBER COMPANY
Heating and Cooling Division
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For commercial and industrial installations using chilled water systems UNARCO also manufactures large capacity chillers (7½ to 75 h.p.) and air handling units.

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Ask your wholesaler for special folder on *Genetron* Super-Dry Refrigerants. Contains pressure-temperature charts and other helpful information.

Coast-to-coast, America's leading Refrigeration and Air Conditioning Wholesalers feature *Genetron* Super-Dry Refrigerants. There's one as near to you as your telephone ready to supply you with complete stocks of *Genetron* Refrigerants and with up-to-the-minute data on their uses.

Remember—*Genetron* Refrigerants are super-dry! Their moisture content is exceptionally low; their overall purity extremely high. They meet the industry's most exacting refrigerant specifications . . . are freely interchangeable with comparable fluorinated hydrocarbon refrigerants produced by any other manufacturer. Follow the industry-wide trend to Super-Dry *Genetron* Refrigerants. Always ask for *Genetron!*

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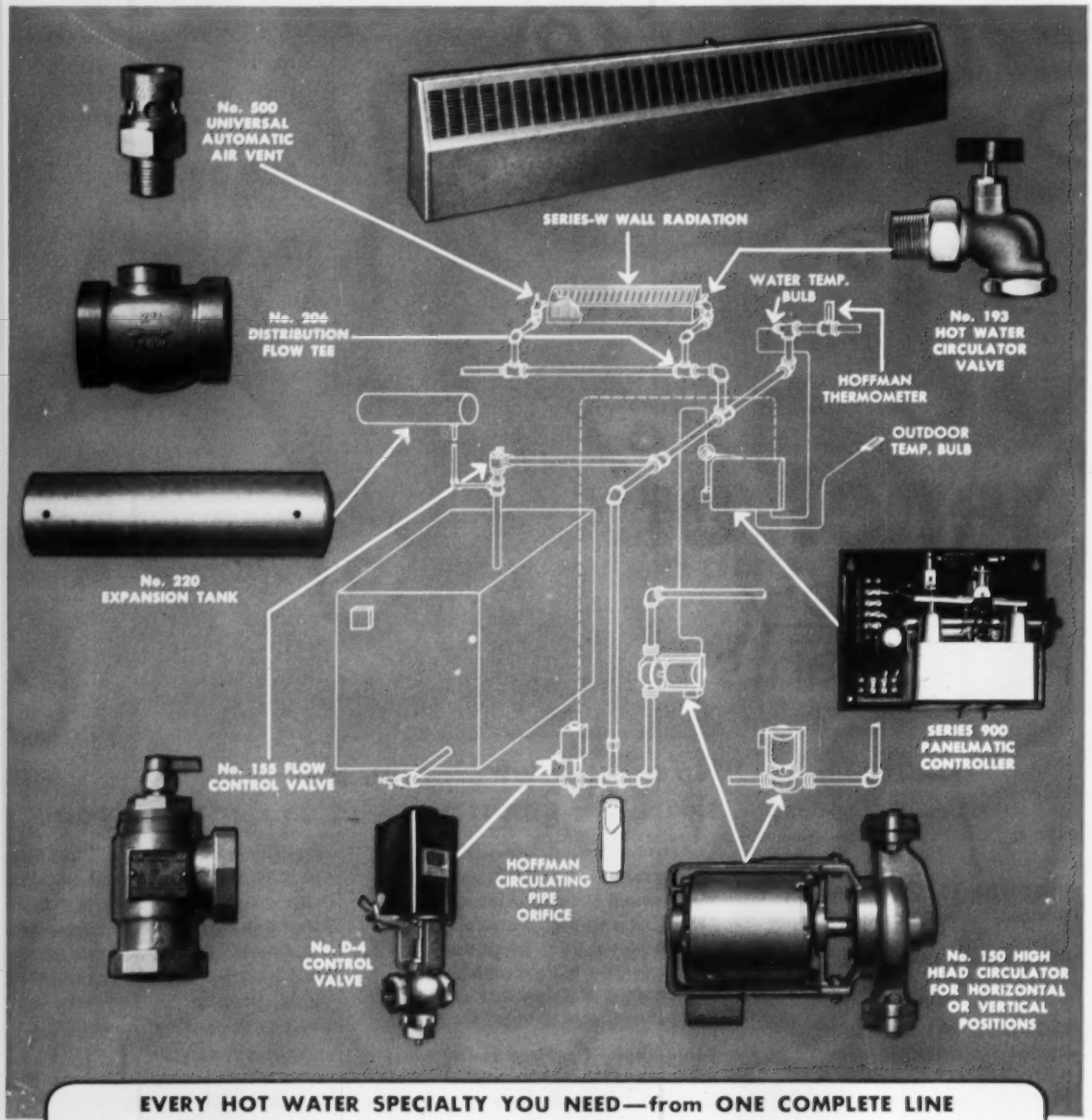
FOR HOT WATER HEATING SYSTEMS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Now you can specify Hoffman products for every spot on a hot water heating system—with three important advantages to you. First, you are assured uniform operating efficiency; second, it saves time from buying to billing; third, it provides one uniform guarantee from a single, recognized source. And, in addition, builders are quick to appreciate the sound Hoffman design features that cost no more than ordinary kinds. New Bulletins on High Head Circulators, Flow Control Valves, Expansion Tanks, Flow Tees, Circulator Valves and Wall Radiation are available, free, no obligation.

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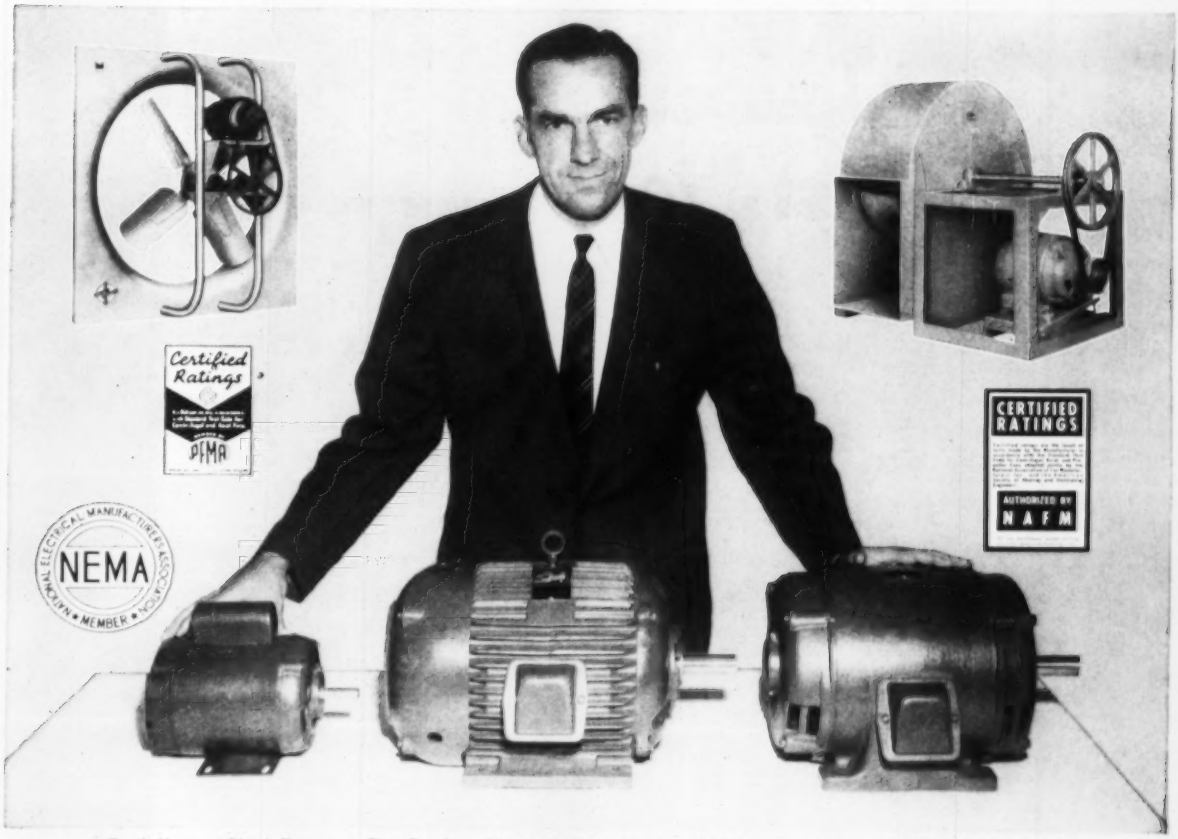

Cecil Young, Chief Engineer, The Peerless Electric Company, with Peerless motors in new NEMA frame sizes.

CAN YOU MATCH THIS?

Peerless is one of the few fan and blower manufacturers that builds its own motors. That's one reason why Peerless fans and blowers conform with all standards—PFMA, NAFM and NEMA. What's more, because we build our own motors, we can match them to fans and blowers for peak performance.

We select motor characteristics which give best results. This versatility permits us to equip our fans and blowers with special motors—custom-built for the jobs they must perform—moving dirty, grit-laden foundry air; working in high heats in electronic cabinets; operating safely in hazardous locations where non-explosive qualities are needed; and operating without failure where uninterrupted service is a must.

Premium-built Peerless motors power famous OEM products in all fields and are the choice of those manufacturers who insist on specials rather than repetitive models. Is it any wonder that Peerless Electric fans and blowers hit such high performance levels.

Select the fans and blowers that meet all industry codes—Peerless. Check the Peerless bulletins. SDA-160 shows performance data on all fans and forward curve blowers. SDA-200 gives complete data on backward curve blowers. Use the coupon below to get your file copy. Dimension prints available on request.

FAN AND BLOWER DIVISION

Peerless Electric **THE PEERLESS ELECTRIC COMPANY**

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THE PEERLESS ELECTRIC CO.
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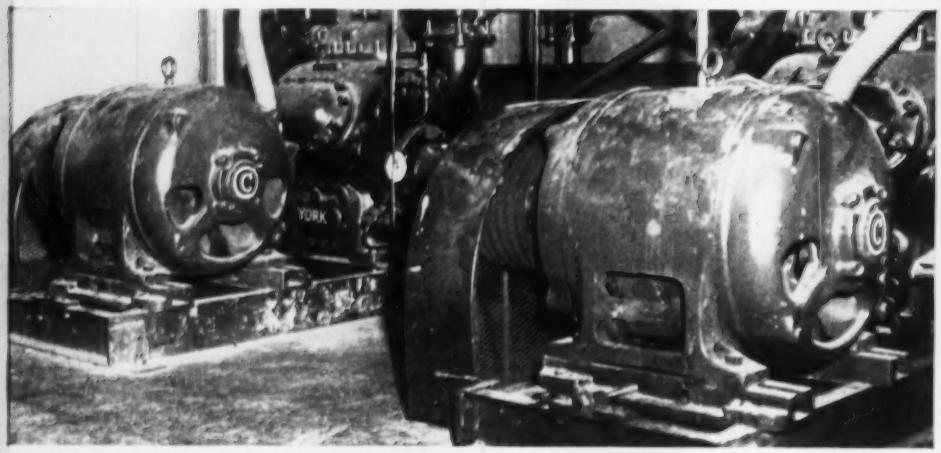
Special low-current starting costs less WHEN YOU SPECIFY

Century PART WINDING START MOTORS

Here's the easy and inexpensive answer to having big motors that will start easily when starting current is limited. Part winding starting is available on all popular size Century motors up to 400 H.P., polyphase, in drip proof, totally enclosed and explosion proof frames, horizontal or vertical mounting.

For fast service from stock, call your nearby Century Distributor or Century District Sales Office.



Two 50 H.P. Century Part Winding Start motors power these unloading type air conditioning compressors. When starting, just half of the winding is energzied, drawing less than two-thirds of normal starting current. In a few seconds, the full winding is connected and the motor delivers full torque at full current.

Get your free copy of our bulletin: "Where Low Starting Current is Required." Mail this coupon today . . .

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Please send copy of bulletin "Where Low Starting Current Is Required"

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MOTORS
1/20 to 400 H.P.

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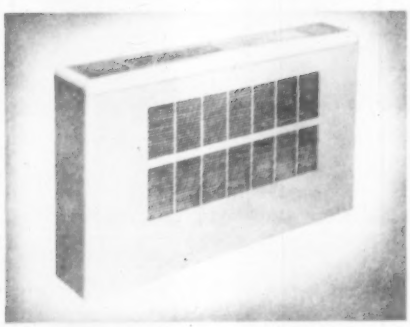
1806 Pine Street • St. Louis 3, Missouri • *Offices and Stock Points In Principal Cities*

for your multi-room jobs...

There's a UniTrane Air Conditioner for any system, any building, any size



All UniTrane Air Conditioners, including the Induction UniTrane model shown above, are designed to filter *all the air* . . . not just primary air. Individually controlled for personal climatic preferences or changing needs.

Now! For complete design flexibility for multi-room air conditioning systems, it's UniTrane Air Conditioners for 1956! This famous TRANE line is now more versatile than ever, with models of *both* basic types . . . *fan coil and induction* . . . to choose from. Units are *trimmer*, with slim, space-saving design. And they're easy to install, with simple piping and wiring connections.

There's a UniTrane model to meet the most exacting requirements for multi-room, multi-story applications —for new or existing buildings, of any size or type. You may choose the attractive floor model (shown above); ceiling types; concealed models for "built-in" applications.

Ask your nearby TRANE Sales Office for complete data on the UniTrane models for 1956. See how they can help you with almost any air conditioning job for any system, any building, any size!

For heating, cooling, ventilating . . .
For any air condition, turn to

TRANE

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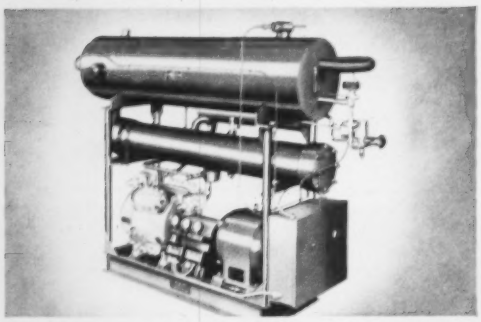

TRANE Cold Generators, "packaged" water chillers for your smaller refrigeration requirements, have multi-step capacity control that reduces starting and stopping, saves power. Cadmium-coated compressor valves for nine times longer life! Now in 8 models, including 125- and 150-h.p. sizes.

For heating, cooling, ventilating...
For any air condition, turn to

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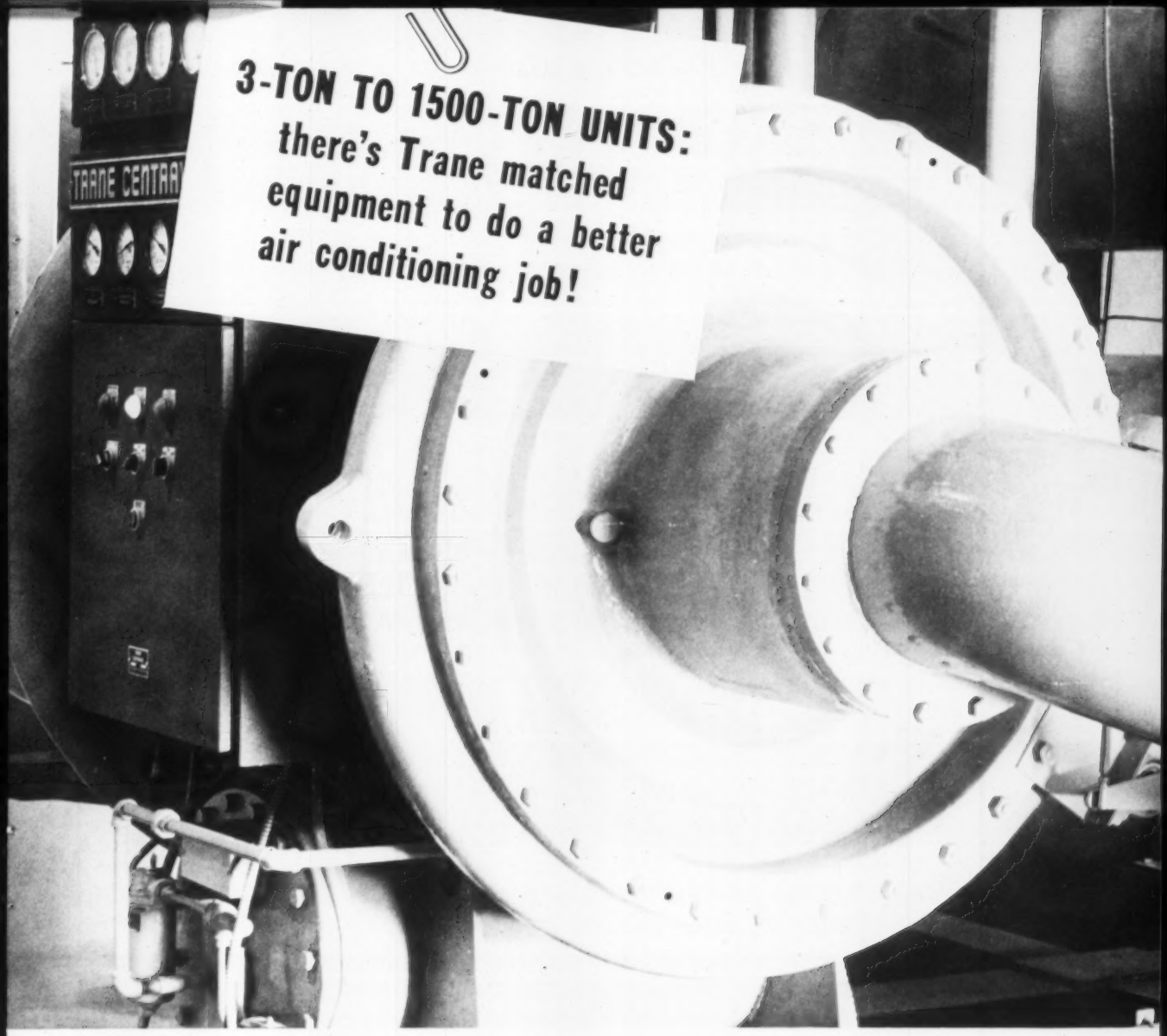
For closer control of air conditioning costs...

Make it a "packaged" size job...CenTraVac

For over 17 years the versatile TRANE Compressor, the *first hermetic centrifugal in the industry*, has simplified problems in design, installation and operation of air conditioning equipment. Completely automatic, it starts, stops, runs by itself—automatically limits its use of power from 100% down to 10%, in *almost direct proportion to the cooling load!*

And now, for 1956, larger size units—up to 1500 tons—give you "packaged" equipment for even the largest air conditioning job. Compact, quiet, vibration-free, the CenTraVac is easy to install . . . *no special bases . . . no field alignment.* Install it anywhere from basement to penthouse—even outdoors!

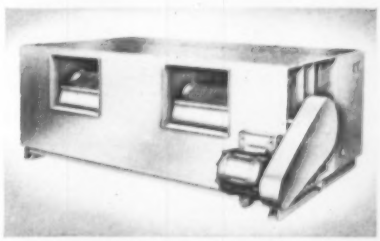
Ask your nearby TRANE Sales Office for complete data on TRANE "packaged" water chillers—the famous TRANE CenTraVacs and Cold Generators—and other TRANE *matched* air conditioning equipment. Or write TRANE, La Crosse, Wis.



3-TON TO 1500-TON UNITS:
there's Trane matched equipment to do a better air conditioning job!

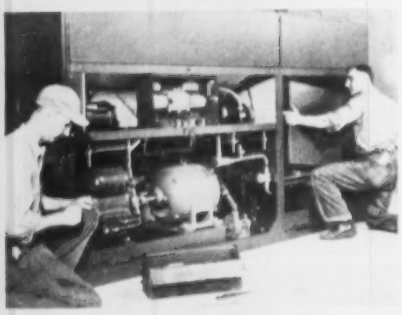
Trane water chiller for any units now up to 1500 tons

TRANE Climate Changers are versatile, flexible air-handling units that help solve a variety of air conditioning design problems. Single zone models, or multi-zone, for handling up to 6 zones at the same time. A wide range of sizes and capacities to 25,000 cfm. May be used for heating or cooling.



TRANE Class III Fans, now in a wider range of *standard* sizes, bring you new freedom of design. Designed especially for high pressure air conditioning systems. 15 *standard* sizes from 18 to 63 inches. Rated capacities to 310,000 cfm. Split housing construction for fast, easy installation.

Trimmer, slimmer, quieter
Trane Self-Contained Air Conditioners meet every engineering requirement



"Commercial" sizes of 10, 15, 20 tons have outstanding dependability that insures efficient performance. Multi-step capacity control reduces starting and stopping, saves power.

Trim, slim, quiet, it's the TRANE Self-Contained Air Conditioner for 1956! Completely redesigned, inside and out, these 3, 5 and 7½ h.p. units pack efficiency and performance into sleek, modern cabinets. And they run so *quietly*, the occupants can hardly hear them—thanks to new TRANE "iso-sound" design that has both fan section and compressor section *floating independently* on sound and vibration isolators.

With a 5-year-guaranteed hermetic compressor as the heart, these complete-in-one-package air conditioners are engineered and built by TRANE. And for your further protection, TRANE has a nation-wide service organization.

For heating, cooling, ventilating... For any air condition, turn to

TRANE

MANUFACTURING ENGINEERS

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At Reading, we make tubing and *only* tubing —in one of America's most modern, completely integrated mills. By specializing, we can deliver a better product to you . . . a product that you can depend upon to build good will, as well as your business.

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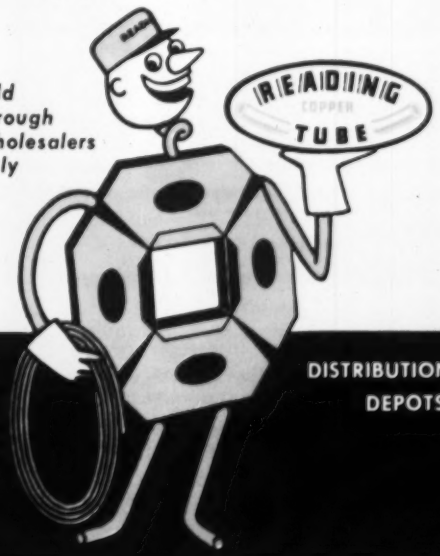
Reading's Field Engineering Department — staffed by competent tubing engineers who are thoroughly trained to handle all types of Copper Tubing problems — is at the disposal of our Distributors at all times.



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SKIL ¼" DRILL

...Model 75 with new Keyless Chuck

Speeds Bit Changing
...Ends Key Fumbling!

Speed Drilling Work on the Job or in the Shop! Although lighter in weight and much easier for the workman to handle, SKIL Model 75 is actually 55% more powerful. Ideal for drilling tough, hard-to-reach jobs in a hurry. Increases worker output and speeds assembly operations. Matchless performance, top operating power, longer life under constant, rugged use.

Addition of high-torque Keyless Chuck now gives fresh working advantages to Model 75 Drill, already one of the most popular tools in the SKIL line.

Advantages that make SKIL the favorite!

- Greater working flexibility—with the new high-torque Keyless Chuck! Greater gripping power than keyed chucks.
- Motor 55% more powerful, yet lighter than previous model.
- Choice of 7 speeds (500 to 5,000 r.p.m.).
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- Comfortable "contour-grip" handle.

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Demonstration and Free Trial will prove SKIL is the answer to your installation bottlenecks! Send coupon today!

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5033 Elston Avenue, Chicago 30, Illinois

☐ I would like a demonstration and trial—FREE!
☐ Please send me illustrated literature on SKIL Model 75.

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COMPANY _____
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All-New "Airfoil" BLADE DESIGN

MOVES MORE AIR--QUIETER

*Both direct-connected and belted types

*Aluminum housing and wheel for easier handling, longer life

ALL-NEW CENTRIFUGAL "AIRFOIL" FANS

The development of Ilg's patented backward-curved, all-aluminum, airfoil blade design opens new horizons in efficient, quiet ventilation. This entirely new blade allows complete freedom from air flow separation at all normal working pressures . . . provides new high efficiency and 25% quieter operation than previous designs. It's the heart of a whole new line of Ilg Centrifugal "Airfoil" Fans!

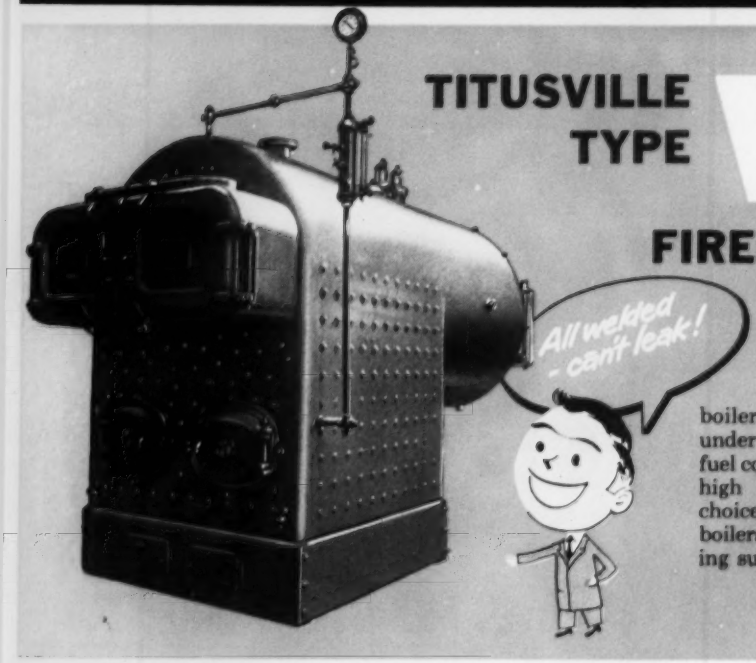
Ilg Type BC Centrifugal "Airfoil" Fans are available with direct-connected or belted drive to meet your specific ventilation requirements. Aluminum housing and wheel eliminate rust problems forever and are ideally suited to the salty atmosphere of seaboard locations. The lighter weight makes handling and installation simpler and more economical. The direct-connected type, with Ilg motors equipped with double-sealed, permanently lubricated ball bearings, reduces maintenance to the vanishing point. *Write for the complete details on this outstanding new concept in centrifugal fan design . . . today!*

ILG 50TH ANNIVERSARY 1906-1956

ILG ELECTRIC VENTILATING COMPANY

2826 North Pulaski Road, Chicago 41, Illinois

LEADERS IN THEIR FIELD!

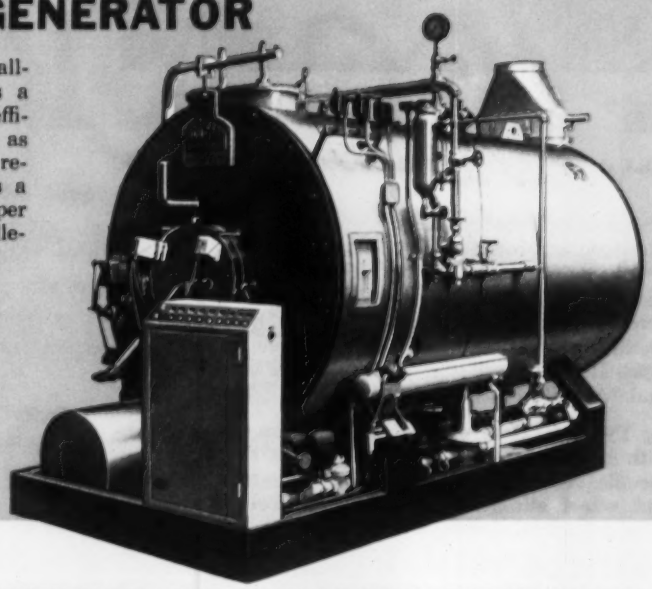


TITUSVILLE TYPE WP FIREBOX BOILER

Precision die formed, fusion-welded into a sturdy one-piece unit, this popular Titusville boiler remains tight and leakproof under all operating conditions. Low fuel consumption, low maintenance and high efficiency make the WP first choice in firebox type high pressure boilers. 12 sizes, 250 to 2500 sq ft heating surface. Bulletin B-3030.

TITUSVILLE Ticosteam PACKAGE STEAM GENERATOR

Completely automatic in operation, the all-welded Titusville Ticosteam Generator is a package boiler with a wealth of features for efficiency and safety. It is ready to go to work as soon as connected to the usual services, requires vent only (no high stack) and has a minimum heating surface of 5 square feet per boiler horsepower. Sizes 20 to 350 H.P. Bulletin B-3100.



TITUSVILLE IRON WORKS CO. TITUSVILLE, PA.

A division of Struthers Wells

THE TITUSVILLE IRON WORKS COMPANY

TITUSVILLE, PENNSYLVANIA

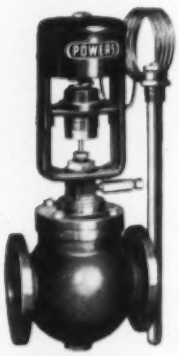
Manufacturers of **A Complete Line of Boilers for Every Heating and Power Requirement**

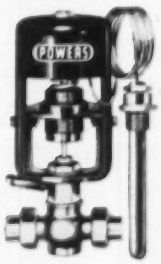
26 year old installation of POWERS No. 11 Self-Operating TEMPERATURE REGULATORS

Each of the four 6" POWERS No. 11 Regulators shown above controls steam supply to a 10,000 gal. water heater. The 4 water heaters provide 140° F. water for use throughout the building.

Often pay back their cost 3 to 6 times a year. By preventing fuel losses caused by OVER-heated water and lasting many years, Powers No. 11 Regulators are a highly profitable investment.

Better temperature control results from their powerful bellows and minimum of valve stem friction. Valve Stem Lubricator aids easy movement of valve stem without binding. Double ply metal used in Powers bellows outlasts ordinary single ply type.





(c69)

POWERS No. 11 Self-Operating TEMPERATURE REGULATORS
Are fully described in Bulletin 329. Write for a copy.

"all are still giving good control"

. . . states Mr. George Volkart, Chief Engineer of Pittsburgh's well known Hotel Wm. Penn. All four of the Powers regulators were installed in 1930. Operating top for one regulator was replaced in 1954. Now (April, 1956) they are still giving the same good control we have had for over a quarter of a century."

Will the temperature regulators you are buying today give performance records like those above? With today's high cost of maintenance, Powers time-proven QUALITY controls are a more profitable investment than ever before.

Right type of Regulator and proper size valve is important for good control. Make sure, call Powers nearest office for help with your problems of temperature control.

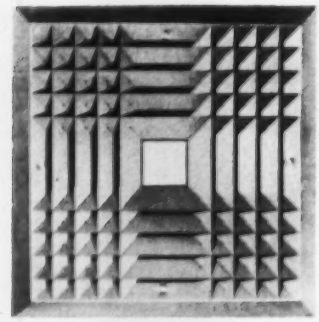
THE POWERS REGULATOR COMPANY

SKOKIE, ILLINOIS | *Offices in chief cities in U. S. A., Canada and Mexico*

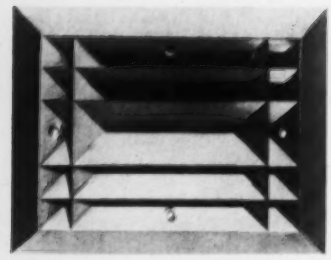
65 years of Automatic Temperature and Humidity Control

ADP

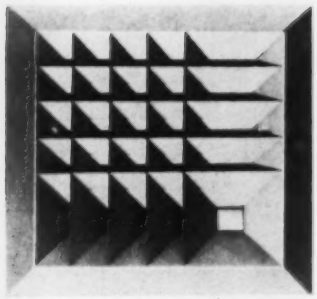
AIR DIFFUSION PLUS



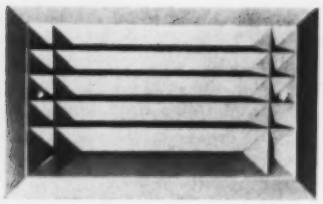
FOUR-WAY



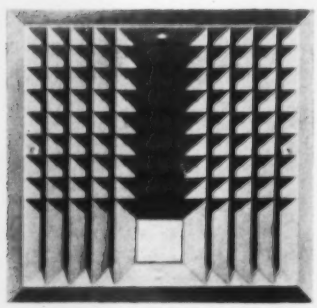
TWO-WAY



TWO-WAY CORNER



ONE-WAY



THREE-WAY

*ADP diffusers are designed and engineered for better air distribution. Greater free areas provide *greater* efficiency—*top* performance. *True pattern control—wall spillage eliminated—complete pattern selection—no blank corners.*

The inner core assures balanced delivery over the face of diffuser. No blank-offs or baffles are required. Complete range of sizes permit selection to meet each job requirement.

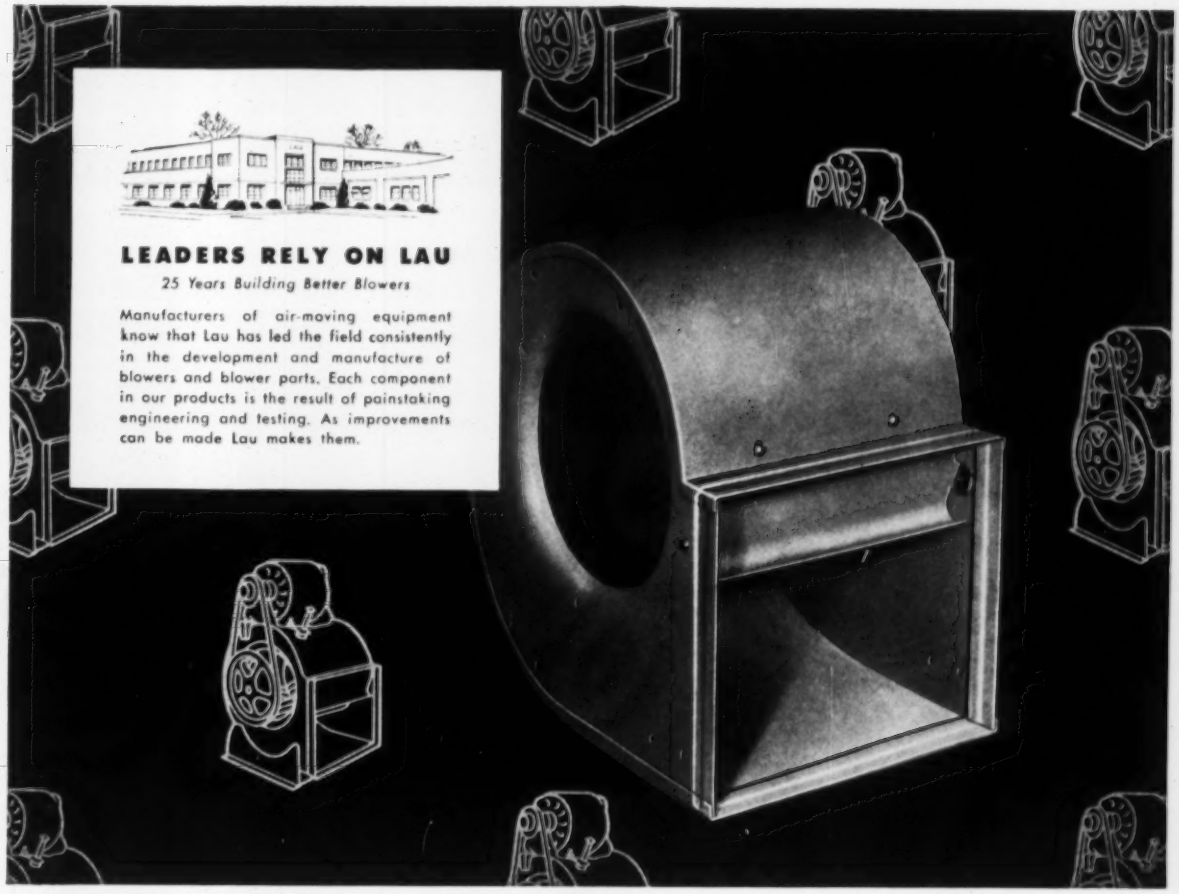
ADP diffusers have a smart and trim appearance for the modern construction and decor of today.

TOB volume control is the only true opposed-blade volume control for ceiling diffusers. Blades are pivoted at edge. Provides the finest adjustment with fast action. No contrasting velocities.

*Patents applied for

AIR DISTRIBUTION PRODUCTS

116 South La Brea Avenue Los Angeles 36, California



LEADERS RELY ON LAU

25 Years Building Better Blowers

Manufacturers of air-moving equipment know that Lau has led the field consistently in the development and manufacture of blowers and blower parts. Each component in our products is the result of painstaking engineering and testing. As improvements can be made Lau makes them.

HERCULEAN HOUSING

This original LAU design has set the pattern for the industry. Of heavy gauge steel, with beading reinforcements around discharge opening to assure uniform size, shape and strength. The offset in scroll sides gives better support to the bearing bracket and allows smooth air flow for maximum blower efficiency. Motor mounting holes are pre-punched for all angles of discharge. The specially designed cut-off is built for extra strength and is permanently fastened in four places. Plated hardware throughout.

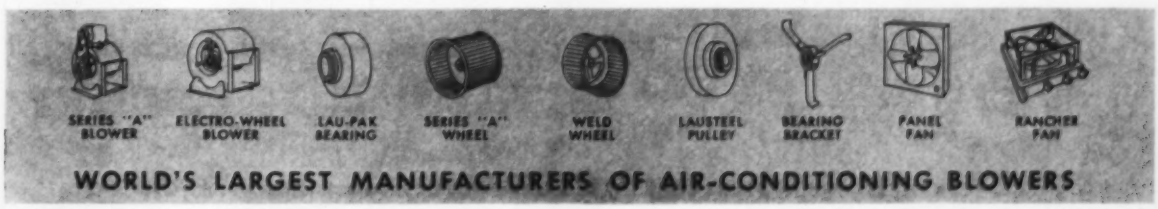
The entire unit is die-formed, lending itself to mass production on precision built equipment. Finished in highest grade baked enamel. Wide range of sizes available.

THE LAU BLOWER COMPANY

2000 Home Ave. • DAYTON 7, OHIO

Other plants at Kitchener, Ont., Canada, and Azusa, California

LB-5, 56



Get the RIGHT COMBINATION for Peak Performance
buy
SPORLAN "G" VALVES
with Selective Charges
"C" CHARGE
for suction temperatures ABOVE ZERO
"Z" CHARGE
for suction temperatures BELOW ZERO
"X" CHARGE
for Extremely Low Temperatures
HERE'S WHY! Over 22 years of engineering research and development have gone into the "G" valve; constantly improving, but never changing the original Sporlan Peak Performance design.
And, way back in 1934, Sporlan engineers originated Selective Charges, which keep proving down thru the years that No One Charge can properly operate a valve on All Applications. So, if you haven't tried Sporlan, just ask any old-timer in the industry . . . he knows that Sporlan "G" valves with Selective Charges have always been the right combination for Peak Performance on all commercial refrigeration applications.
Try them yourself . . . order Sporlan "G" valves with Selective Charges from your Sporlan wholesaler today, and ask him for a new Sporlan Catalog showing the proper Catch-Alls and Solenoid Valves to go with them.
Better still . . . Buy Sporlan Right-Down-The-Line and get Peak Performance throughout.
C
ZERO
Z
X
Joe Service
SPORLAN VALVE COMPANY
7525 SUSSEX AVE., ST. LOUIS 17, MO.

5-Hp. Unit serving three rooms.

Right: Municipal offices cooled with Frick Unit Conditioners

TRADE FRICK MARK®

Air Conditioning—

Packaged Units or Central Systems

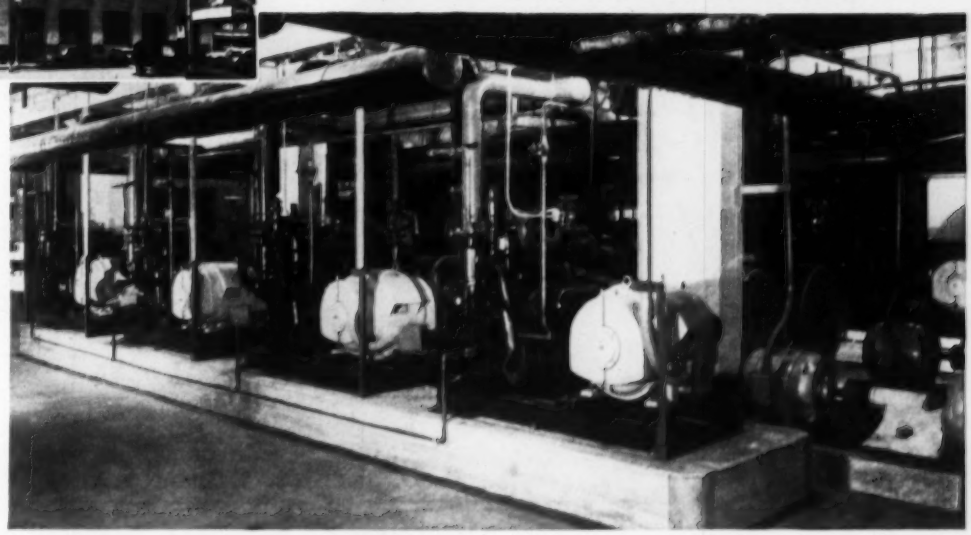
From a 3-hp. unit to a plant requiring thousands of tons of refrigeration is a long step, but they're both included in Frick-engineered air conditioning.

Built into Frick systems are 50 years' experience in air conditioning, nearly 75 in refrigeration, and over 100 in engineering. Nowhere else can you get this unique combination of experience and complete service. Ask for estimates today: write

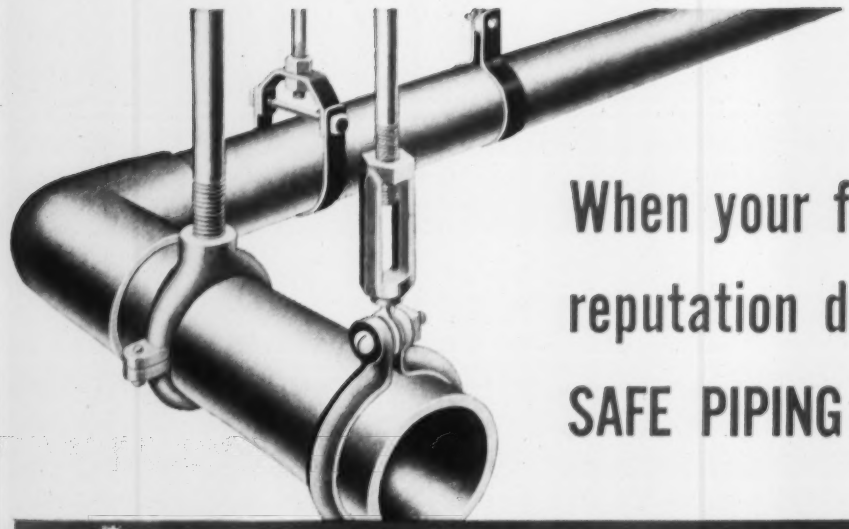
DEPENDABLE REFRIGERATION SINCE 1882

FRICK CO.

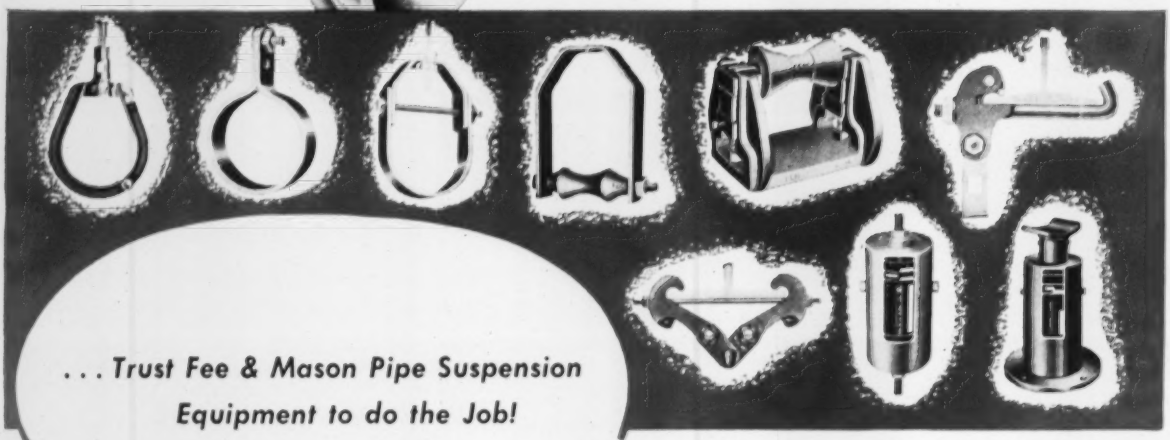
WAYNESBORO, PENNA. U.S.A.



The two 11-story buildings of the American National Insurance Co., at Galveston, are air conditioned by the multiplicity of 75-hp. "ECLIPSE" compressors shown at right. Thousands of fine buildings are Frick-equipped.



When your future reputation depends on SAFE PIPING SUPPORT...



. . . Trust Fee & Mason Pipe Suspension Equipment to do the Job!

Specification and installation don't end the job . . . it's the years of safe, trouble-free support in pipe suspension systems that really count.

Fee & Mason's wide selection assures your using the right pipe hanger or support to do your job. And Fee & Mason's "life-of-building" engineering guarantees the longer-life and adequate pipe support that keeps your customers happy!

FEE & MASON

AMERICA'S LEADING SPECIALISTS IN PIPE HANGERS AND SUPPORTS

Since 1893

FEE & MASON MFG. CO., INC. • MANASQUAN, NEW JERSEY

THERE'S A F&M STOCKING WHOLESALER IN YOUR TOWN!

NEW "SA" FLO-CONTROL VALVES

COMBINATION STRAIGHT-ANGLE PATTERN

...always the right valve for the job

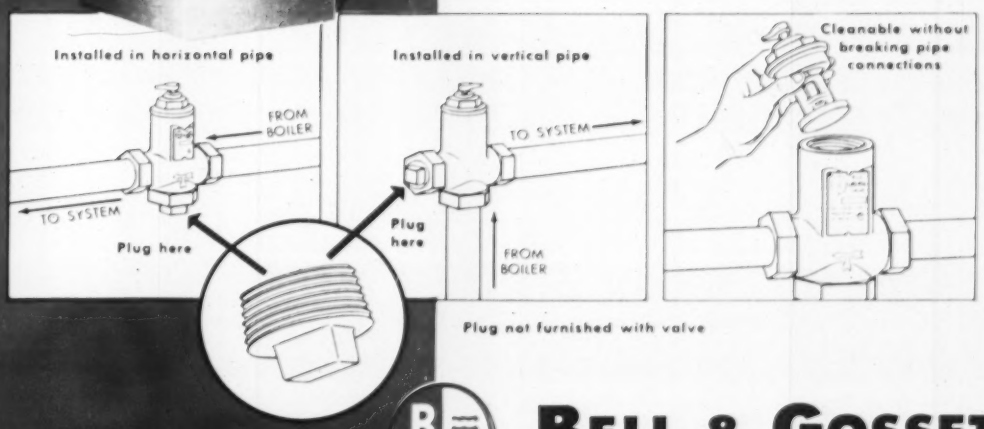
...simplifies stocking

Another B&G advance in product design...for greater convenience in installing forced hot water heating systems! The new "SA" Straight-Angle Flo-Control Valve can be installed in either horizontal or vertical pipe lines—giving the installer wider latitude in meeting various piping problems.

The "SA" is available in sizes 1" - 1¼" and 1½"—replacing the same sizes in individual straight and angle pattern valves. They conform in every detail to the high manufacturing standards which have made B&G Flo-Control Valves known for positive, tight seating and dependable operation.

ALL B&G FLO-CONTROL VALVES *ARE EASY TO CLEAN!*

Whether "SA" type or regular angle and straight patterns, B&G Flo-Control Valves can be cleaned without breaking pipe connections. Just unscrew the top cap—lift out the valve mechanism—clean the valve—replace the cap.



Plug not furnished with valve

BELL & GOSSETT
COMPANY
Dept. EI-5 Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, West Toronto

General Manager Bechtold of Kern Ice and Cold Storage Company, Inc., points out one of two banks of SPANG Pipe serving a 40′ x 60′ cold storage room. Total plant storage area is 972,000 cu ft.

Again . . . SPANG Pipe lives up to its reputation

10 YEARS COLD . . . AND STILL GOING STRONG!

"After carrying corrosive anhydrous ammonia for more than 10 years and weathering frequent exposure to SO_2 gas used to protect grapes from insect and fungus life, our SPANG CW Piping is ready for another 10 years of service!" says Mr. R. E. Bechtold, general manager of Kern Ice and Cold Storage Company, Inc., Bakersfield, California.

"The fact that we have been able to completely forget about our piping system is an indication of how much we can rely on it. SPANG Pipe has done a fine job for us."

Kern Ice and Cold Storage Company, Inc., which opened for business in 1945, stores potatoes, grapes and frozen foods for farmers and distributors at temperatures ranging from 40°F above to 40°F below zero. Installed at the time of construction were 5,016 ft of 2" SPANG CW Steel Pipe to carry the refrigerant.

Cold storage service is a tough assignment for pipe. Corrosive anhydrous ammonia attacks the interior, while the exterior is exposed to SO_2 gas. This latter chemical forms a sulphurous acid when combined with frost on the pipes.

But SPANG CW Pipe stands up to this at Kern. After 10 years of service, the SPANG Pipe is in excellent shape and has never leaked, despite these rugged conditions. Management at Kern counts on years more of *top-quality* service from SPANG.

That's the story of SPANG service at Bakersfield. It can do the same for you in any piping installation. Try SPANG CW Steel Pipe on your next job. Call your local SPANG Distributor.

SPANG-CHALFANT
DIVISION OF THE NATIONAL SUPPLY COMPANY

General Sales Office: Two Gateway Center, Pittsburgh, Pa. District Sales Offices: Atlanta, Boston, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis

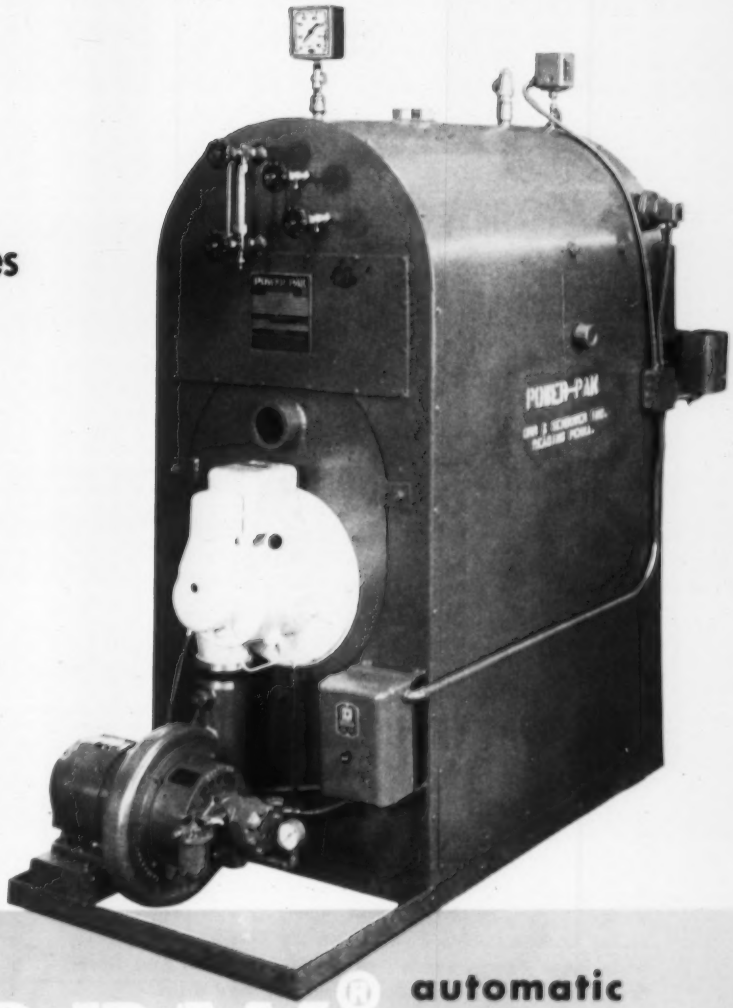
SPANG CW STEEL PIPE

NEW

money-saving "package" for heating and hot-water service!

Money-saving advantages

- low complete cost
- completely factory-assembled
- saves floor space
- factory fire-tested
- operating simplicity
- rugged industrial burner
- water heating coils
- automatic controls
- quiet operation
- smokeless combustion
- easy over-all accessibility
- one-source responsibility for complete unit
- nation-wide factory-schooled service



O&S

POWER-PAK®

automatic packaged boiler

• Here is today's best buy in boilers for providing dependable, cost-saving, low-pressure steam or hot water heating for a wide variety of commercial and industrial requirements. Its many money-saving features make POWER-PAK the ideal boiler for heating loads up to 25 hp in schools, churches, motels, markets, stores, restaurants and taverns, bakeries, florists, garages, warehouses, launderettes, industrial plants or any other requirements within its capacity range. You can count on POWER-PAK for dependable, money-saving performance because it is built and backed by the builders of *Powermaster*—the modern packaged boiler with industry-wide recognition for quality and service satisfaction.

Investigate the advantages of POWER-PAK for your heating requirements. Send for Bulletin 1233 for more information on this new money-saving boiler.

Builders of Dependable Boilers Since 1885

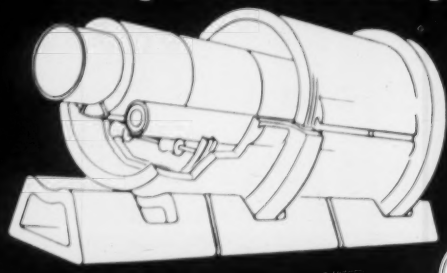
ORR & SEMBOWER, INC.

Morgantown Road, Reading, Pa.

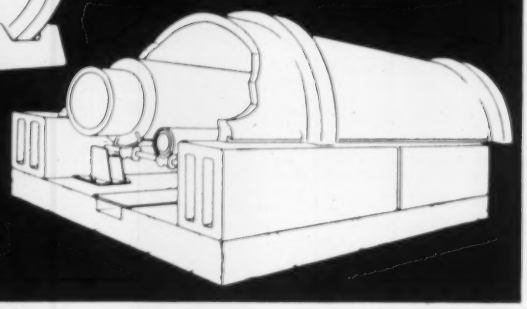
don't build a PIPING JUNGLE!

GO UNDERGROUND

...and assure *permanent* protection for your metal piping investment



ROUND SYSTEM . . . supplied complete with combination underdrain and support structure. Available in 12 sizes, each with the proper underdrain support.



TUNNEL SYSTEM . . . installed on a simple concrete pad. With Tunnel Arch in ten sizes and Side Blocks in three sizes, any combination of piping can be used.

STILLWATER CONDUIT SYSTEMS

There's one material that never wears out underground. That's vitrified clay. And vitrified clay is the major component of Stillwater Conduit Systems—both Tunnel and Round types. When you run your service piping underground, through Stillwater Conduit, you not only eliminate unsightly jungles of overhead pipe . . . you protect that piping permanently . . . and you lay it straight and true, with fewer "runarounds" to avoid obstacles, and fewer fittings that cause turbulence and pressure drop.

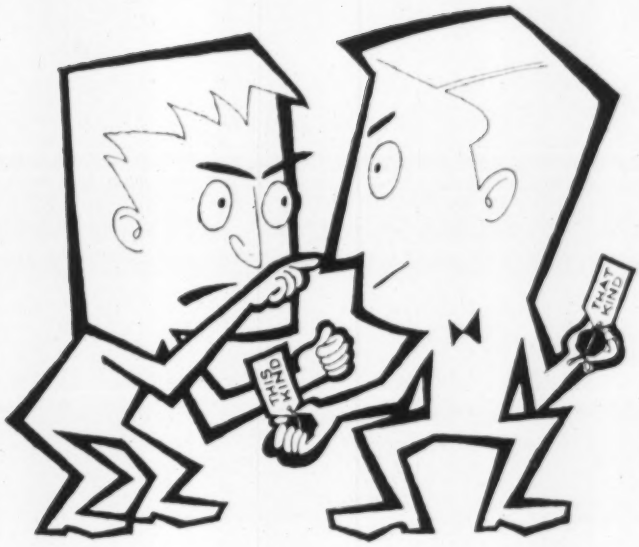
Stillwater Conduit Systems are completely unaffected by extremes of temperature or moisture, or the attack of corrosive soils and ground waters. They provide the *best possible* protection for the enclosed metal service piping. We'll give you all the engineering help you need to design the complete system—and we'll follow through by supervising the actual construction job. Large warehouse stocks assure prompt shipment of any size order, complete with all accessories.

Any combination of service piping can be accommodated by Stillwater Conduit Systems, using either filler or sectional insulation.

WRITE FOR *new four-page, file-size bulletin, with full details*

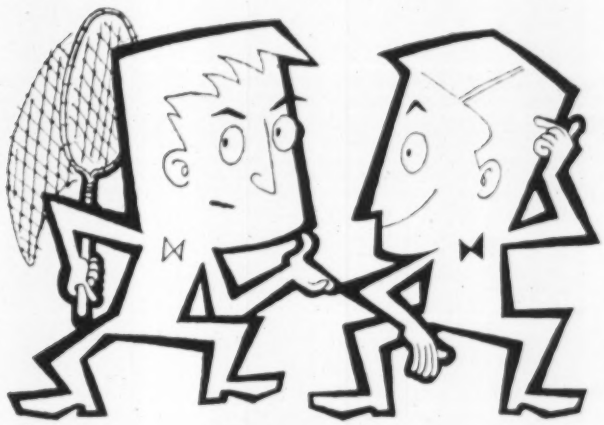
The Stillwater Clay Products Co.
STILLWATER CONDUIT DIVISION
3334A PROSPECT AVENUE. CLEVELAND 15, O.

SW-156-62



What's the big idea buying several kinds of coal for our steam plants?

It's a good idea. The kind of coal that burns most economically in the old boilers isn't efficient for the new ones.



How do you know you're right?

Look at the coal bills. We are generating more steam at a lower fuel cost. You can tell from the ashes we are getting more complete combustion, and there's less clinkering.

Where did you get this idea, anyway?

From the C & O Coal Department. They convinced us that different types of burning equipment need different types of coal. From the high quality coal produced on the C & O, we selected the quality and size of coal that works best in our particular installations.

P.S.

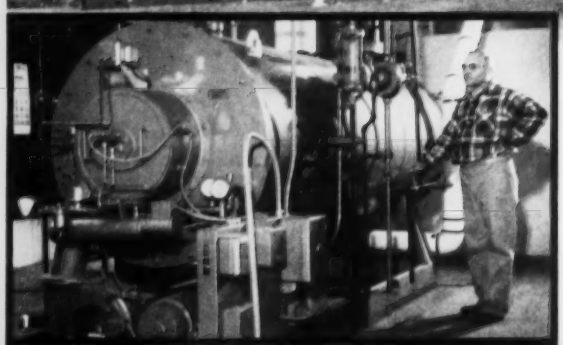
There's a lot more to buying coal than the cost per million BTU. Why not contact coal producers on the C & O to solve your particular fuel requirements, or write to: R. C. Riedinger, General Coal Traffic Manager, Chesapeake & Ohio Railway Co., Terminal Tower, Cleveland 1, Ohio, for the assistance of a C & O fuel service engineer.

Chesapeake and Ohio Railway

WORLD'S LARGEST CARRIER OF BITUMINOUS COAL

THEY SPELLED
E-C-O-N-O-M-Y
7 WAYS HERE

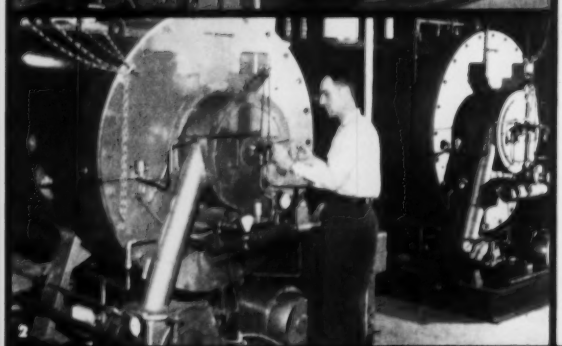
seven examples of how YORK-POWER equipment is meeting the rigid heating requirements of Architects, Engineers and School Authorities . . *all over America*

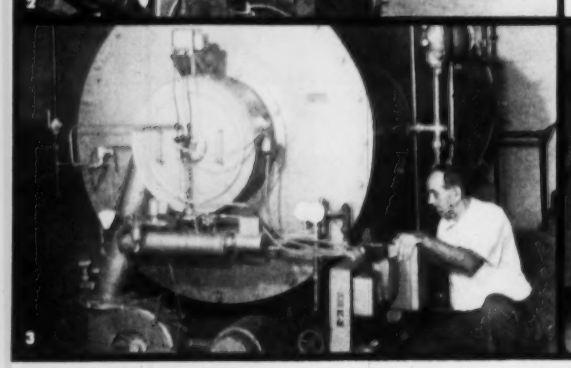


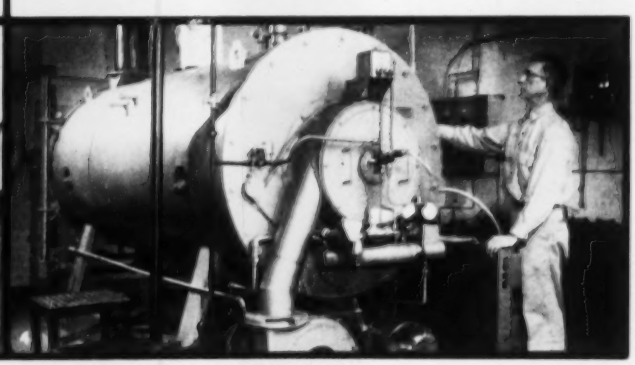
THESE seven modern schools, built in recent years in one section of Pennsylvania, are excellent examples of the high type of acceptance which YORK-POWER school-heating equipment has won and is winning in many other parts of the country.

Writes C. S. Buchart, Registered Architect, York, Pa., who designed these seven schools: "The York-Power Steam-Pak units installed in our projects have proven to be great space savers providing compact, neat, efficient heating installations of the advanced type required for economical planning."

States W. K. Hood of W. K. Hood & Associates, Inc., consulting engineers on these jobs: "We specify a Scotch marine type boiler for projects which require compact units with maximum efficiency. Many of these installations have York-Power equipment. They are providing economical, easy-to-operate service."







1. **ELEMENTARY SCHOOL, MT. ZION, PA.** This handsome, modern school, erected in 1954, is economically and efficiently heated by this single 60-hp York-Power Steam-Pak, (SPL53-60-5).

2. **ALEXANDER D. GOODE ELEMENTARY SCHOOL, YORK, PA.** Dependable and economical heat for this large elementary school is provided here by two 125-hp York-Power Steam-Paks (SPL53-125-5).

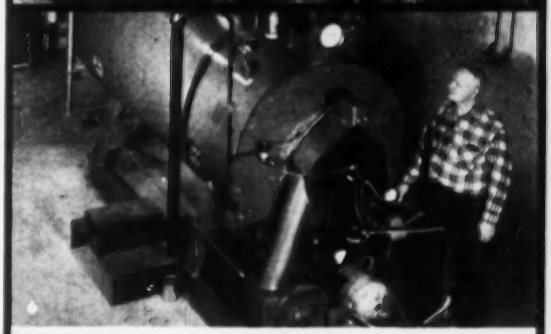
3. **ELEMENTARY SCHOOL, NEWBERRY TOWNSHIP, PA.** Illustration shows the heart of this school's heating system—a 100-hp York-Power Steam-Pak (SPL53-100-5).

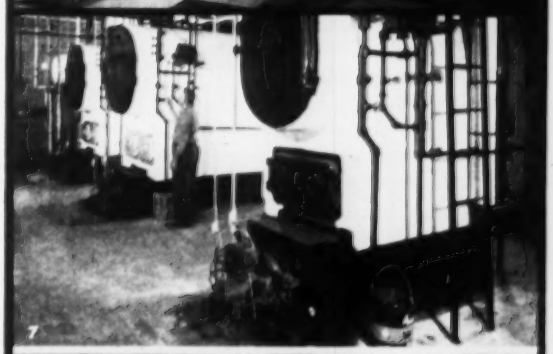
4. **ELEMENTARY SCHOOL, FISHING CREEK, PA.** For this school, a single 60-hp York-Power Steam-Pak (SPL53-60-5) is sufficient to provide plenty of clean, economical heat and hot water.

5. **ELEMENTARY SCHOOL, CONEWAGO, PA.** Maximum heating efficiency is obtained here with two 75-hp York-Power Steam-Paks (SPL53-75-5).

6. **LIGHTNER ELEMENTARY SCHOOL, YORK, PA.** This 50-hp York-Power Steam-Pak (SPL53-50-3) provides abundant, economical heat for the above-mentioned school. Illustration **below** shows combination auditorium and cafeteria with tables that fold into the wall. York-Power keeps pace with such modern school equipment ideas.

7. **YORK TOWNSHIP ELEMENTARY SCHOOL.** Big savings and greater heating efficiency have been reported by this school since they converted two 50-hp coal-fired boilers by the installation of York-Power Horizontal Rotary Oil Burners. A third 25-hp boiler was installed in the space formerly occupied by the coal bin. Each unit is controlled by Factory-Coordinated panels (**below**). All controls were wired at the factory, eliminating costly on-the-job installation.

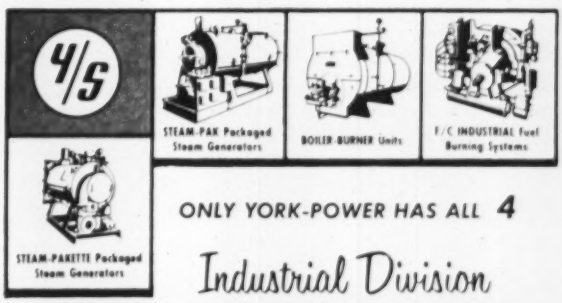




YORK-POWER UNITS in use everywhere

Remember, wherever you go you'll find York-Power heating installations similar to these . . . installations which are meeting the high performance and low-cost demands of state, county, and municipal school authorities—as well as industry and commerce.

YORK-POWER Units are designed and built to fire light oil, heavy fuel oil; mixed, manufactured or natural gases, or a combination of oil and gas. Your nearest York-Shipley Representative will be happy to help you with the solution of any school heating problem. Call him or write directly to YORK-SHIPLEY TODAY.



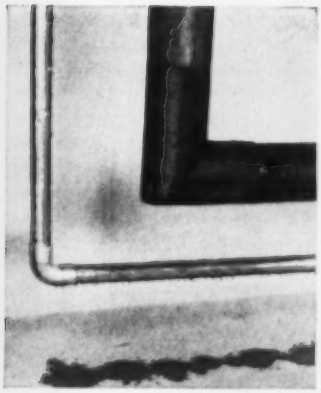
ONLY YORK-POWER HAS ALL 4

Industrial Division

YORK-SHIPLEY, INC.

YORK, PENNSYLVANIA

Fast, easy-to-apply Armaflex pipe covering can be slit lengthwise, snapped in place, and sealed with Armstrong 520 Adhesive on lines already in operation. If applied at the same time as piping is being installed, Armaflex can be slipped on, readily follows bends in copper tubing without cutting or fitting.



Stops condensation, when used in ½" thickness, under normal design conditions on indoor lines operating at temperatures above 32° F. On heating cycle, Armaflex will withstand 200° F.

A self-extinguishing material, new Armaflex will not support combustion and may be slipped in place over copper tubing and held back with clamps while sweat fittings are made.

Joints are cemented with Armstrong 520 Adhesive. This easy-to-handle adhesive furnishes a tight, vaporproof bond. No other sundry is required on an Armaflex pipe covering job.

New insulation for liquid cooling and heating lines is

flexible for fast, easy installation

Extreme flexibility of Armstrong Armaflex* allows fast insulation of liquid cooling and heating lines. It can be compressed without damage, applied in close quarters, and bent to fit the contour of formed tubing. On the job, Armaflex can be slipped on while pipes or tubing is being installed or slit and snapped over lines that are already in place.

Made of a resilient, foamed plastic, Armaflex will not crumble, chip, or rub off. Waste is negligible. Fitting covers can be made up easily and rapidly from miter-cut pieces.

No separate vapor barrier is needed on Armaflex installations. The foamed cellular composition is a positive vapor seal. Because Armaflex stays dry in service, its high K factor of 0.28 at 75° F. remains high for the life of the installation.

Armstrong Armaflex is made in ½" and ⅜" thicknesses for pipe and tubing to 3⅛" I.D. Pieces are 6' long.

For free booklet containing complete data on this remarkable new insulation material, call your nearest Armstrong office or write today directly to Armstrong Cork Company, 2005 Sherman Street, Lancaster, Pennsylvania.

Armstrong
INDUSTRIAL INSULATIONS

*TRADE-MARK

DOUBLE-FLOW AQUATOWERS* ARE

Original...

Marley Double-Flow Aquatowers, like all successful original products, have an invaluable advantage. They were designed to fill a definite economic need, not to secure a share of an existing market. And, drawing on the experience of hundreds of installations and on 35 years of specialization in cooling tower design, Marley constantly improves Double-Flow Aquatowers. Marley engineers are uninhibited, unconfined by tradition; they have a single objective – the finest low-silhouette cooling tower for the commercial-institutional capacity field. This is why Double-Flow Aquatowers continue to be the outstanding choice of engineers, architects and contractors on three continents.

*Trademark Reg.

The Marley Company MARLEY Kansas City, Missouri

CHASE® soft temper Copper Water Tube makes a neater, faster radiant heating job!

You can save time and *still* do a quality radiant heating job...with Chase Copper Water Tube. Its soft temper means it can be bent *by hand*. Its long 60 and 100 foot lengths mean you make fewer joints. Both of these features mean a faster, neater installation.

Lightweight Chase Copper Water Tube is easy to handle, easy to install. It can be joined quickly with leak-proof Chase Solder-Joint Fittings, using standard soldering techniques. Result—a radiant heating system that stays pressure-tight *for good!*

Chase Copper Water Tube and Chase Solder-Joint Fittings are available in all sizes from your Chase Wholesaler. Call him today.

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Chase Copper
adds extra value
to any home!

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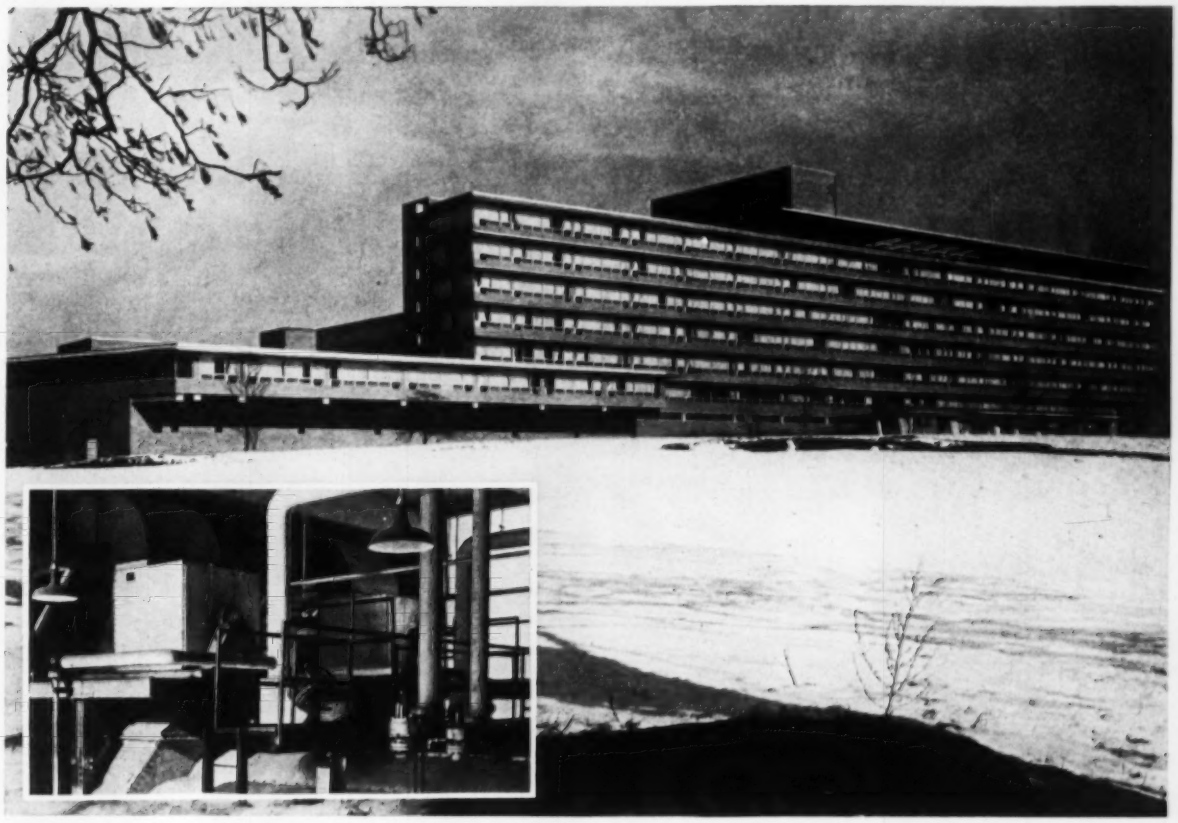
Vincent G. Kling, Architect | A. Ernest D'Ambly, Mechanical Engineer | W. M. Anderson Company, Mechanical Contractors



The Last Word in Modern Hospital Design Naturally Uses the Last Word in Mechanical Draft

THE LANKENAU HOSPITAL, in the suburbs of Philadelphia, is one of the world's most modern hospitals, both in architecture and equipment. The hospital itself was established in Philadelphia in the mid-nineteenth century, and has a distinguished history. It moved to its new building in 1953. In specifying equipment, its designers selected the most modern, the most efficient, the most scientific that could be found.

When it came to draft inducers for the boiler plant, they naturally selected Wing, which fulfill all those requirements, and in addition have back of them a lineage almost as old as Lankenau's own.

Wing Draft Inducers cut capital cost through elimination of high stacks, reduce maintenance costs, and result in sizeable fuel savings. They provide positive, adequate, uniform draft for boilers or furnaces entirely independent of weather conditions. And they save money through higher fuel-burning efficiencies. You should learn more about them. Write for Bulletin I-56.

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L. J. Wing Mfg. Co. 140 Vreeland Mills Rd., Linden, N.J.
Factories: Linden, N.J. and Montreal, Canada

WING REVOLVING HEATERS

WING FRESH AIR SUPPLY HEATERS

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Engineered Air Distribution

Performance *Guaranteed* with Venturi-Flo ceiling diffusers

1 Opposed-blade volume control operated through face of diffuser

2 Allen head adjusting screw raises and lowers inner assembly to produce deflections ranging from horizontal to vertical

Barber-Colman *guarantees* performance of Venturi-Flo Ceiling Diffusers when they are used according to published data. With Venturi-Flo you get a high rate of aspiration for efficient diffusion, quiet operation. Deflection and opposed-blade volume controls are quickly and easily adjustable after installation. Rigid construction prevents damage during shipping and installation. Select from a wide range of sizes and styles, both recessed and surface types. Contact your nearby Barber-Colman Field Office, or write . . .

Barber-Colman Company

DEPT. E, 1101 ROCK STREET, ROCKFORD, ILLINOIS, U. S. A.

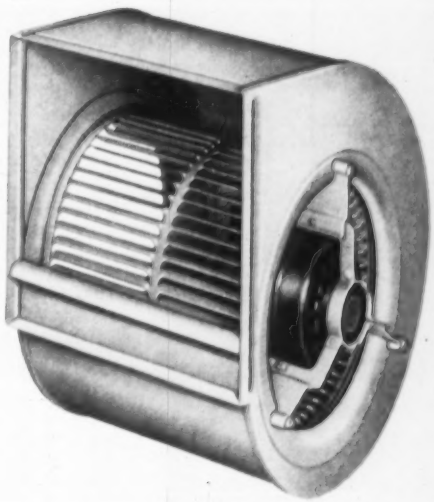
NOW IT CAN BE

SOLD

Dealers have found that one of the biggest drawbacks to sales of residential heating-cooling combinations is the problem of *noise*. Now progressive manufacturers are supplying dealers with larger units equipped with Utility's new "Big Boy" Direct Drive Blowers. "Big Boy"—a burly brute of a fan—is packed with *quiet* power that proves this equipment *can* be sold when it has the added sales appeal of silence.

With airflow capacity great enough to handle up to 125,000 BTU—3-ton heating-cooling combinations, "Big Boy" delivers approximately 1,400 to 1,500 CFM at a static pressure of 0.80" WG. It's the most quietly powerful direct drive blower now available.

Utility was first with a line of silent direct drive blowers with Neoprene hubs. Now Utility is first again! Here is a silent direct drive blower with Neoprene hubs and super-quiet permanent split capacitor motor. Why not get together with your manufacturer on the proposition that silence is a golden opportunity for increased sales—for him, for *you*? Remember only Utility's "Big Boy" Direct Drive Blower gives your equipment the power it needs *and* the silence that sells it.



Check with Utility for blowers and blower parts in any combinations. You'll find that . . .

YOU CAN'T MATCH UTILITY FOR PRODUCT AND PRICE!

UTILITY FAN CORP.

911 East 59th Street, Los Angeles 1, California

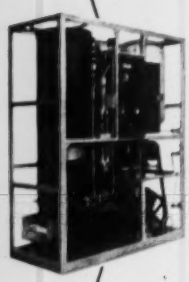
Manufacturers of heavy and standard duty blowers for heating, air conditioning and ventilating installations. Producers of blowers and blower parts for original equipment manufacturers. Write for catalogue data.

A DIVISION OF UTILITY APPLIANCE CORP.

ALLEN-BRADLEY

TROUBLE-FREE MOTOR CONTROLS

have been "standard" on Vogt Tube-Ice machines for over 18 years



Continuously dependable service . . . that is the reason Allen-Bradley motor controls are "standard" on so many refrigeration units . . . such as the Vogt Tube-Ice machine, shown here.

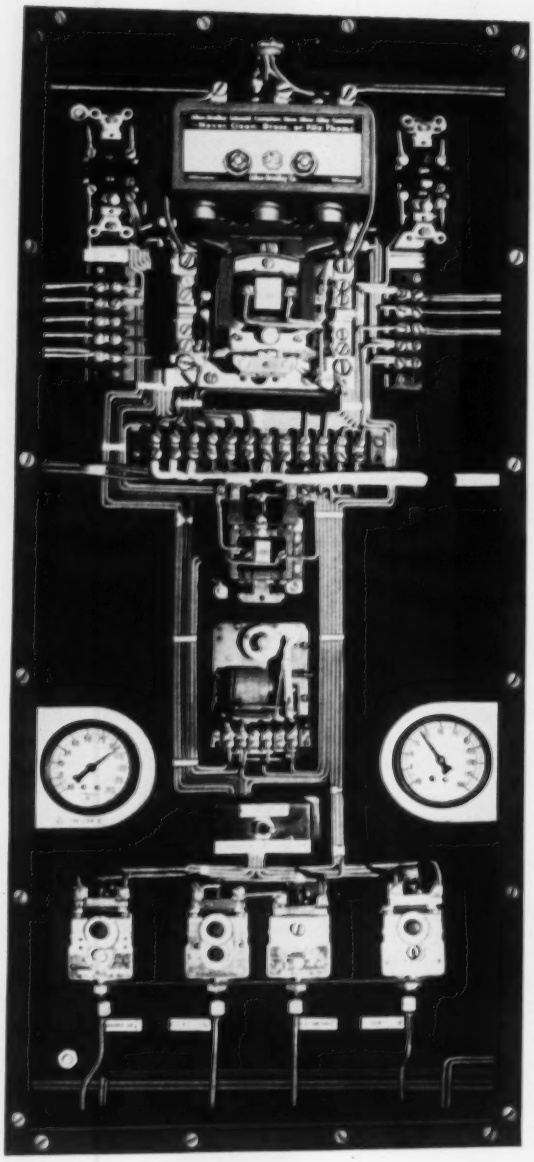
The simplicity of Allen-Bradley solenoid starters makes such performance possible . . . there is only ONE moving part . . . nothing to wear or bind . . . your guarantee for continuous, trouble-free operation. The double break, silver alloy contacts never need maintenance. You can install Allen-Bradley controls . . . and forget them.

Permanently accurate thermal overload relays protect motors against burnout. Specify Allen-Bradley . . . you'll never have reason to regret this decision.

Please write for your copy of the latest Allen-Bradley Handy Catalog . . . the guide to "Quality" motor control.

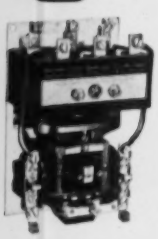
Allen-Bradley Co.
1335 S. First St., Milwaukee 4, Wis.

In Canada
Allen-Bradley Canada Ltd., Galt, Ont.



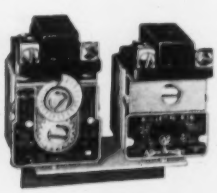
Above panel shows Allen-Bradley controls for 5,000 lb automatic Vogt Tube-Ice machine

THE SIGN OF QUALITY
MOTOR CONTROL



BULLETIN 709
Across-the-line solenoid starter

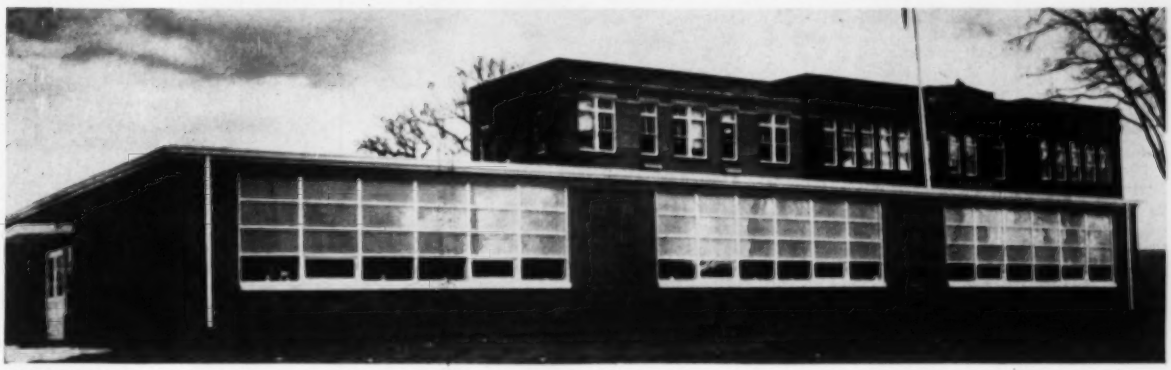
BULLETIN 700
A-C control relay, universal type



BULLETIN 836
High and low-pressure cutouts

ALLEN-BRADLEY
SOLENOID MOTOR CONTROL
QUALITY

GILSULATE® helps Wisconsin School build 5 modern classrooms for less than $55,000



Cadott School

"The installation of this material is so simple that it is almost unbelievable."

E. F. Klingler & Assoc., Eau Claire, Wisc.

Considering that most modern schoolroom construction costs average well over $30,000 per classroom, the low cost of the Cadott School is outstanding.

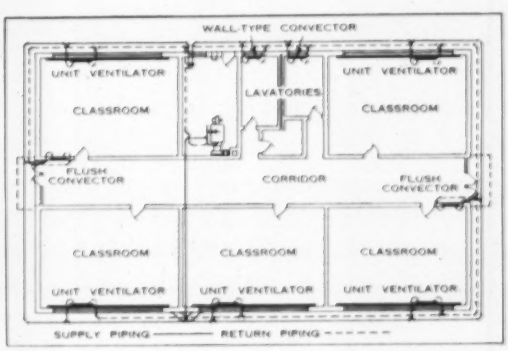
Several unique design features were incorporated in the building—among them, running steam and return mains about 6" outside the foundation lines of the building, eliminating costly crawl space or pipe tunnel construction.

For pipe insulation, E. F. Klingler & Associates chose GILSULATE. The pipes were covered with GILSULATE to a thickness of four inches on all sides, and backfilled. At the highest point in the lines, there are six inches of fill over the insulation and at the low point, about two feet. GILSULATE is so effective that at no time during the winter did the snow melt above the pipes—or even thaw the earth.

No other method for insulating and protecting hot underground pipes can match Triple-Zone GILSULATE for low cost of installation, efficiency and permanence. Fill in coupon below for complete details.

FACTS ABOUT GILSULATE

1. **EASY TO USE**—just pour and tamp...pipe heat does the rest.
2. **FORMS 3-ZONES** of protection against heat loss and all hazards commonly encountered by hot buried pipes.
3. **NEEDS NO HOUSING OR MECHANICAL SHEATHS**: no mixing, special handling or equipment.
4. **ONLY NEEDS NORMAL PIPE SPACING**: for multiple pipe or cramped conditions.
5. **THREE TYPES AVAILABLE**:
   Type A for 200°-310° F. temp. range
   Type B for 300°-385° F. temp. range
   Type C for 385°-520° F. temp. range



Cadott School floor plan

THE TRIPLE-ZONE INSULATION FOR LIFETIME PROTECTION OF HOT UNDERGROUND PIPES

GILSULATE®

AMERICAN GILSONITE COMPANY, SALT LAKE CITY 1, UTAH
Affiliate of Barber Oil Corp. & Standard Oil Co. of California

American Gilsonite Co.
1348 West Broadway, Salt Lake City 1, Utah or **1145 East Jersey St. Elizabeth, N. J.**

Send me more information on GILSULATE Insulation

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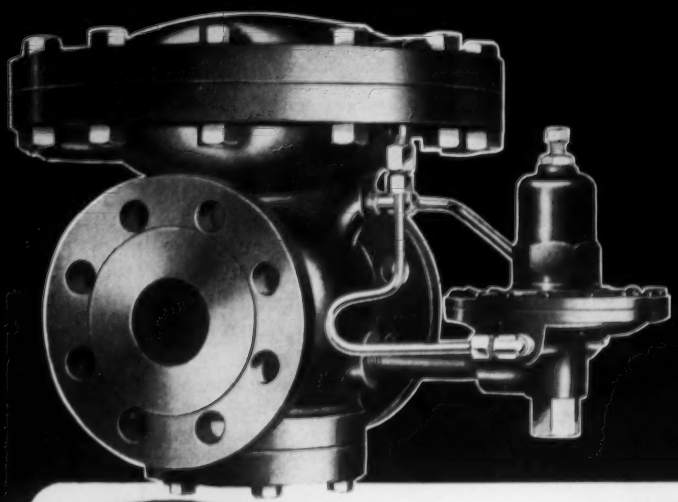
HPA

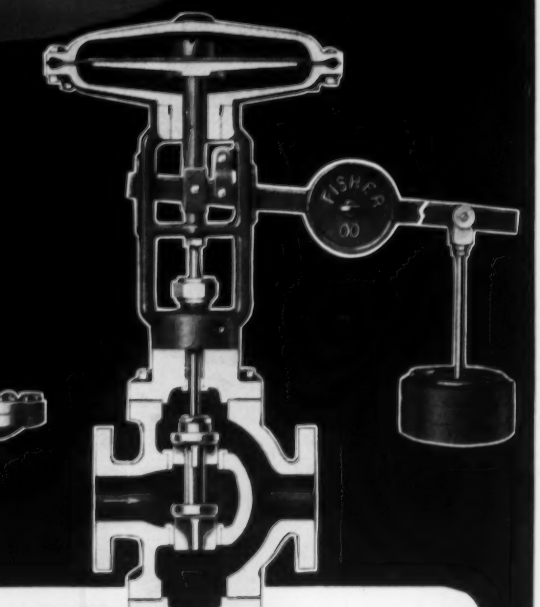
The Standard of Comparison

FOR THE HEATING INDUSTRY

FISHER®



TYPE 92A



TYPE 10A

PILOT OPERATED PRESSURE REDUCING VALVE

Built for long dependable service for steam pressure control. The 92A features single seated hardened stainless steel construction, assuring tight closure and preventing excessive pressure build-up. Pilot control maintains desired reduced pressure with remarkable accuracy. Two pilot assemblies for high or low pressure are available and interchangeable.

Sizes ½" to 2" screwed; 1" to 6" flanged. Reduced pressure ranges 3 to 200 PSI. Inlet pressures to 250 PSI at 450°.

LEVER and WEIGHT CONTROLLED PRESSURE REDUCING VALVE

An extremely sensitive, simple yet rugged controller for reducing steam or gas pressures. Double ported globe bodies can be inverted to allow conversion to a relief valve. Swing-link yoke and balanced lever construction permits installation with diaphragm either above or below pipeline.

Sizes ½" to 2" screwed; 1" to 10" flanged. Reduced pressure ranges ½ to 100 PSI. Inlet pressures to 600 PSI at 800° or 1200 PSI at 100°. Bronze or stainless steel trim.

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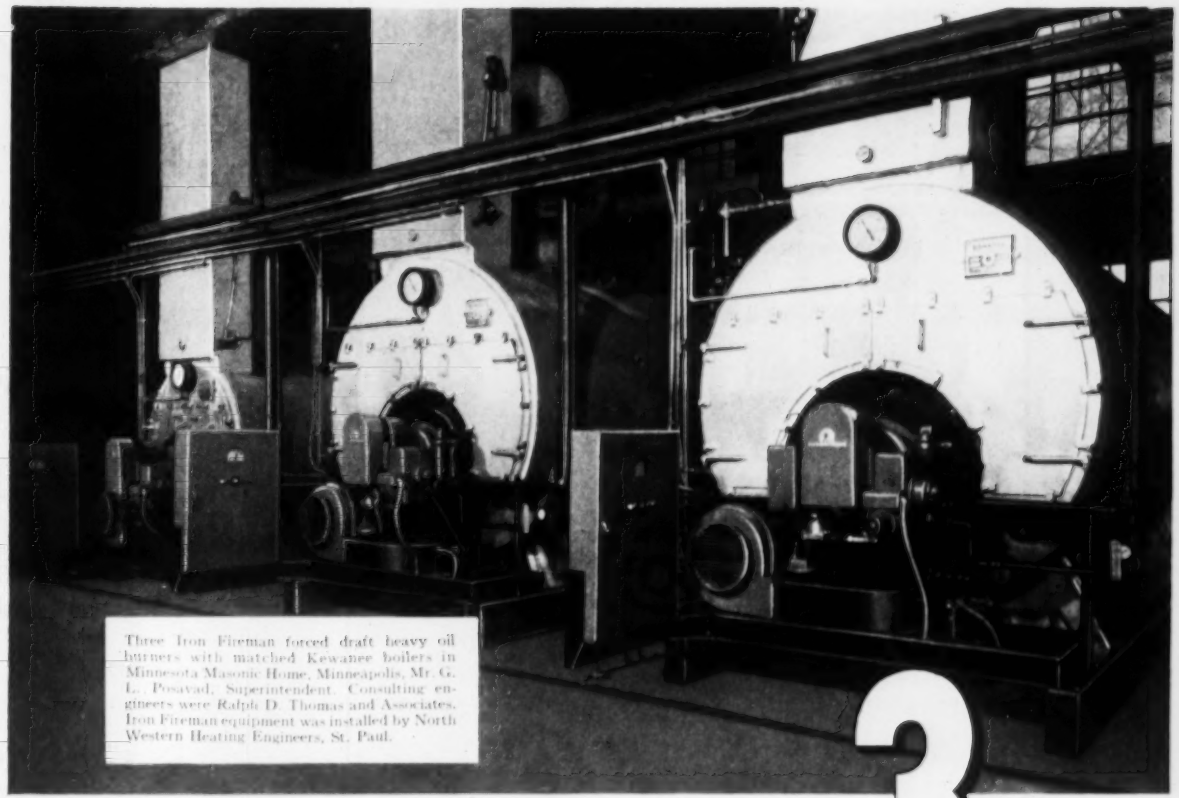
FISHER GOVERNOR COMPANY • MARSHALLTOWN, IOWA

WORLD LEADER IN THE MANUFACTURE OF PRESSURE REGULATORS AND IN RESEARCH FOR BETTER PRESSURE CONTROL

Since 1880



Three Iron Fireman forced draft heavy oil burners with matched Kewanee boilers in Minnesota Masonic Home, Minneapolis, Mr. G. L. Posavad, Superintendent. Consulting engineers were Ralph D. Thomas and Associates. Iron Fireman equipment was installed by North Western Heating Engineers, St. Paul.

Why it paid to split this steam plant 3 ways

Heating engineer explains why he used three Iron Fireman firing units with matched Scotch boilers in Minnesota Masonic Home

Steam costs were getting out of hand. Should the old steam plant be modernized, or replaced?

After careful analysis of all possible alternatives, a new steam plant was recommended by Mr. A. C. Hunter, president of the engineering firm of Ralph D. Thomas and Associates. This involved replacement of three high pressure HRT boilers, automatic firing equipment, surge tank, feed water heater and all other accessories.

The new plant was designed for low pressure operation, using three boiler-burner units with Iron Fireman forced draft oil burners, in which boilers and burners are engineered as a single integrated unit. Says Mr. Hunter, "Boiler sizes were based on a small unit for summer operation, a large unit for normal winter load, a large unit for standby, and operation of any two for winter peaks." The new plant provides an increase of nearly 70 per cent in rated boiler capacity to take care of future needs for heating, kitchen, water heating and infirmary.

Even with this substantially larger plant, Mr. Hunter's studies showed that the savings in fuel, maintenance and operating costs will return the entire investment in 7 years.

IRON FIREMAN FORCED DRAFT BURNERS

Each Iron Fireman firing unit is a complete combustion system, consisting of burner, forced draft air supply, fuel system and control panel. All elements are assembled, wired and tested at the factory and mounted on a single base ready to attach to the boiler front. The unit can be installed with a matched Titusville or Kewanee Scotch boiler designed specifically for this burner, or in any other type of boiler.

FOR GAS, OIL OR GAS-OIL COMBINATION

The Iron Fireman forced draft burner is available for either oil or gas, or in a dual-fuel combination unit in which fuels can be shifted instantly with no break in operation. Any grade of oil can be used, from lightest to heaviest, without special adjustment. Fires natural gas (high or low pressure), manufactured, mixed, or bottled gas. Firing unit adaptable to any type of boiler.

Send coupon for further information.

IRON FIREMAN®

Automatic Firing Equipment for Heating, Processing and Power

IRON FIREMAN MANUFACTURING CO.
9045 W. 166th Street, Cleveland, Ohio.
(In Canada, address 80 Ward St., Toronto, Ontario.)

Please send technical information and specifications on Iron Fireman Forced Draft firing systems.

Name_____

Firm_____

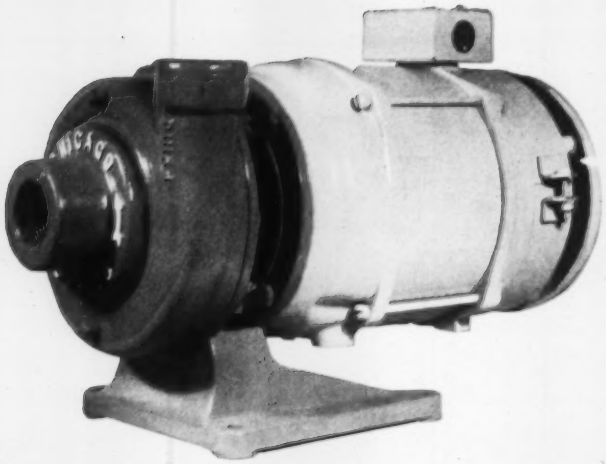
Address_____

City_____ State_____

CC

CLOSE-COUPLED

PUMPS*



All Pumps in stock

Shipped same day order received

TYPICAL C-C SERIES PUMP APPLICATIONS ARE:

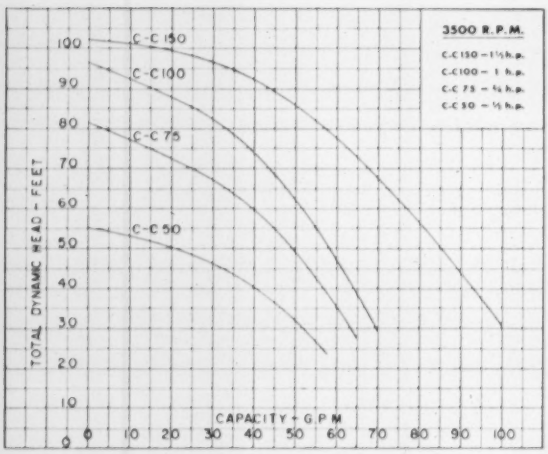
Cooling Towers • Air Conditioning

Chilled Water Circulating

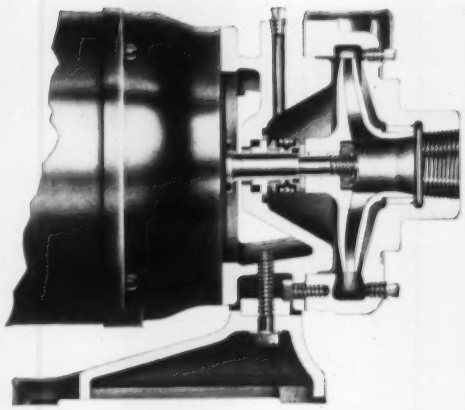
Hot Water Circulating

Pneumatic Water Systems

Booster Systems



*For cooling towers, etc.



C-C Series pumps are equipped with a Leak-Proof "Chicago Mechanical Seal". Each pump operates over the entire range of its curve quietly and smoothly without motor overload. Write to Department B for Bulletin 103-G.

CHICAGO PUMP COMPANY

Subsidiary of Food Machinery and Chemical Corporation

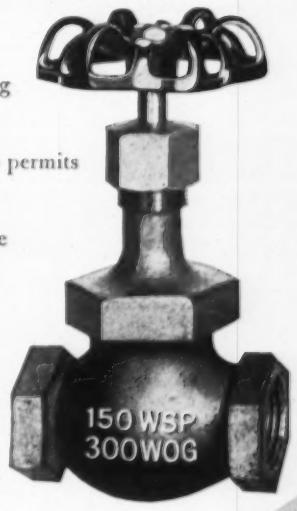
BUILDING PUMP DIVISION

622 DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS

Condo-Vac ®, Sure Return ®, AVC, LVC, Fire, House & Circulating Pumps, Pneumatic & Tankless Water Systems. Flush Kleen ® Sewage Ejectors, Little Giant ® & Non-Clog Bilge Pumps. Pumps for every Industrial use.

BUILT FOR SEVERE SERVICE

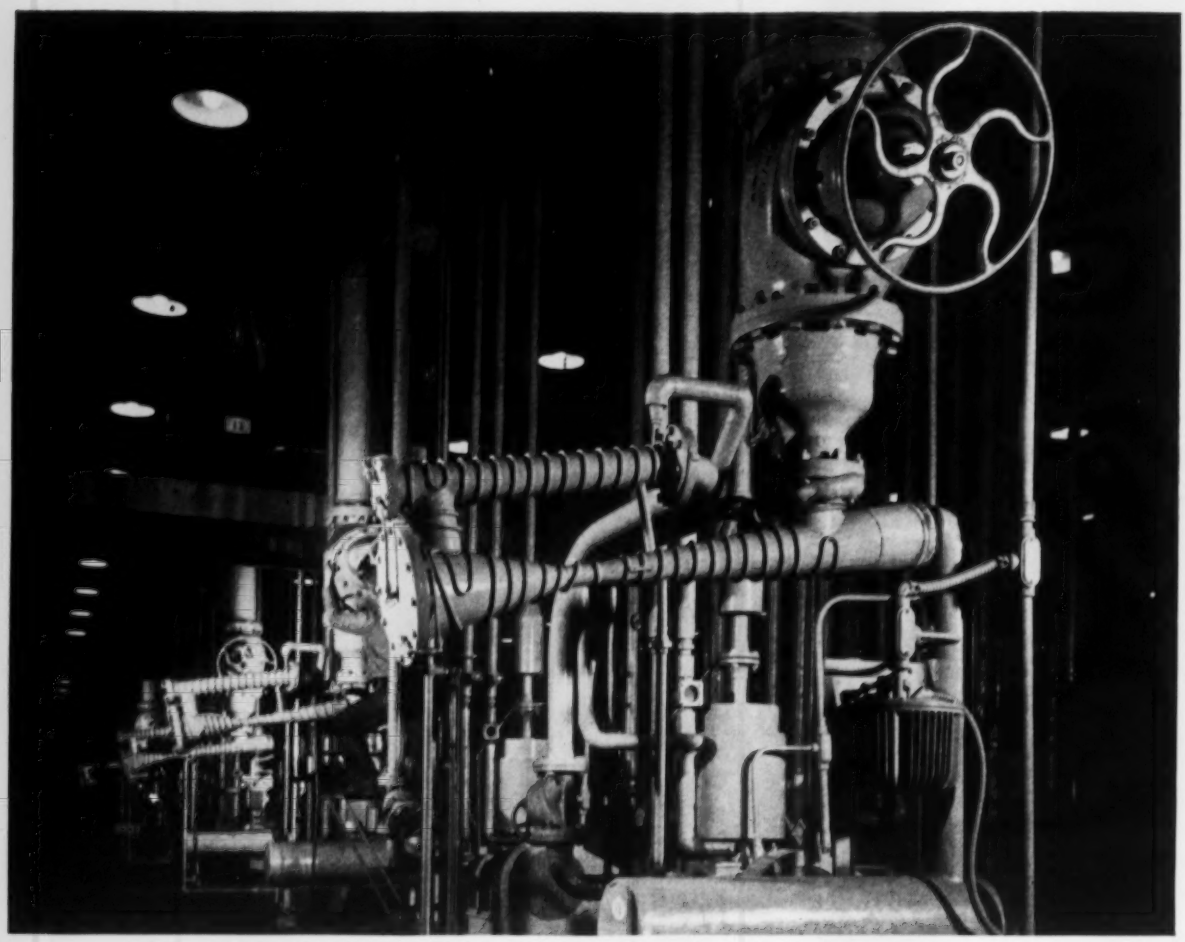
O-B Globe Valves are designed for long life. For example, instead of making stem and disc holder in a single piece, Ohio Brass makes them separately. This permits "free swivel" action, with reduced wear on disc and seat. You can get O-B Globe Valves with long-life disc construction from your Ohio Brass distributor.



Ohio Brass

MANSFIELD OHIO, U.S.A.

4380-V



These Crane valves holding 25 microns absolute pressure after 2 years on vacuum service

The Case History—Valves frequently are the most critical points in a vacuum system. But that's not the case with this large Southern light metals refiner.

This plant reports no trouble or expense over a 2-year period in maintaining a vacuum of less than 25 microns absolute for its distillation process.

The tight-holding valves installed about 2 years ago on the lines from vacuum pumps shown above are Crane No. 1611 diaphragm pattern. These 12-in. packless iron body valves are used about once daily.

They've allowed no in-leakage at the seat, bonnet-joint, or through the diaphragm. No maintenance whatever has been given the valves since installed. They operate easily and look good for such service indefinitely.

This high efficiency performance is mainly due to Crane separate disc and diaphragm design. The diaphragm used as a bonnet seal only is not subject to destructive crushing. Conventional type disc and body seat provide a metal-to-Neoprene seating that's ideal for vacuum and hard-to-hold fluids.

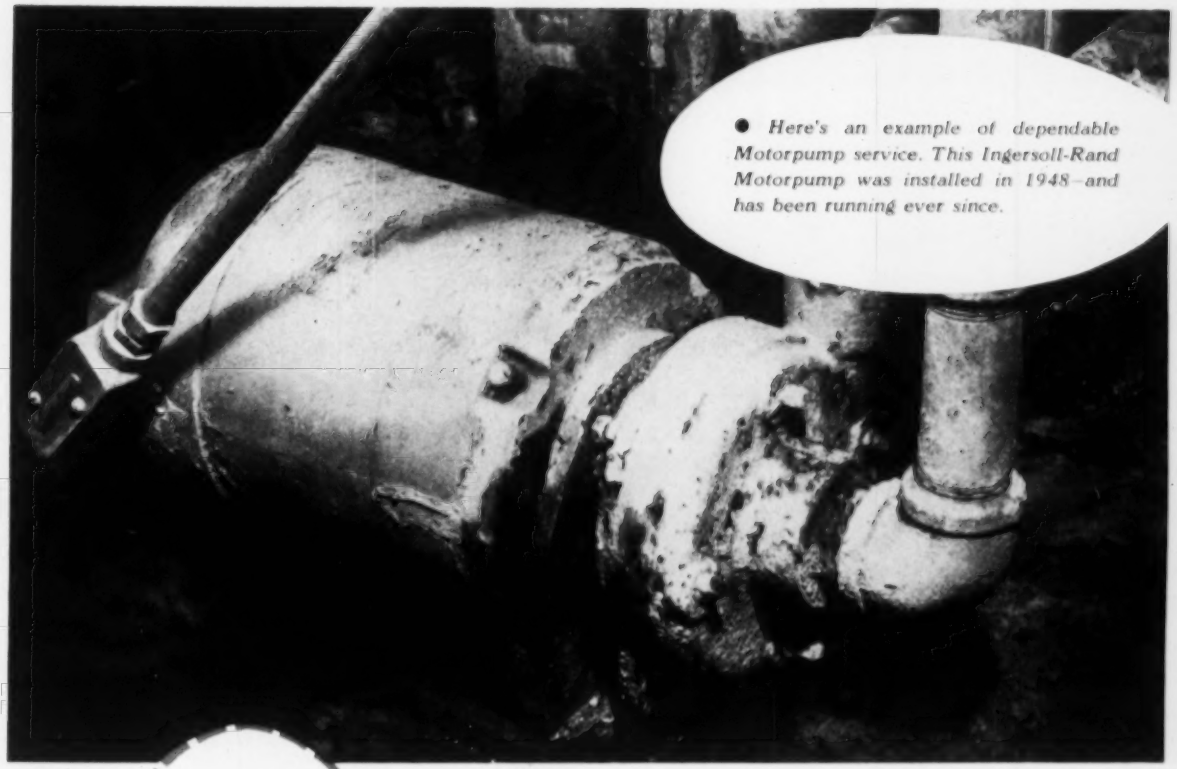
Moderately priced, Crane diaphragm valves deserve your consideration for many ordinary services, as well as sludges, slurries and corrosive fluids. They are made in a wide variety of body and trim materials, in ½ to 12 in. sizes.

Ask your local Crane Representative about them, or write to address below for literature.

CRANE VALVES & FITTINGS

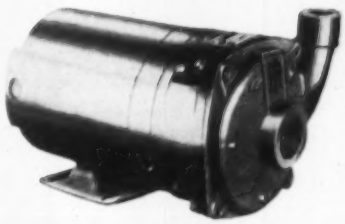
PIPE • KITCHENS • PLUMBING • HEATING

Since 1855—Crane Co., General Offices: Chicago 5—Local Service Everywhere Through Branches & Wholesalers



● *Here's an example of dependable Motorpump service. This Ingersoll-Rand Motorpump was installed in 1948—and has been running ever since.*

Texas installation proves LONG LIFE, LOW MAINTENANCE OF MOTOR PUMP



- ***Sizes up to 75 hp***
- ***Compact, space-saving***
- ***Operate in any position***
- ***Simple installation***

One of the big reasons why Ingersoll-Rand's Motorpump is specified as an integral part of so many air conditioning systems is its compact, rugged design and trouble-free operation. Motorpumps are built to give efficient, low-cost operation—and here is just one instance where performance paid off many times over:

> The 1 hp, 3 phase Motorpump was installed in Corpus Christi, Texas in 1948 on a 5-ton air conditioning system. It has outlasted one compressor unit and one tower, and they've had to replace piping. Existing records and the pump's appearance indicate that there has been no maintenance. It is still in operation.

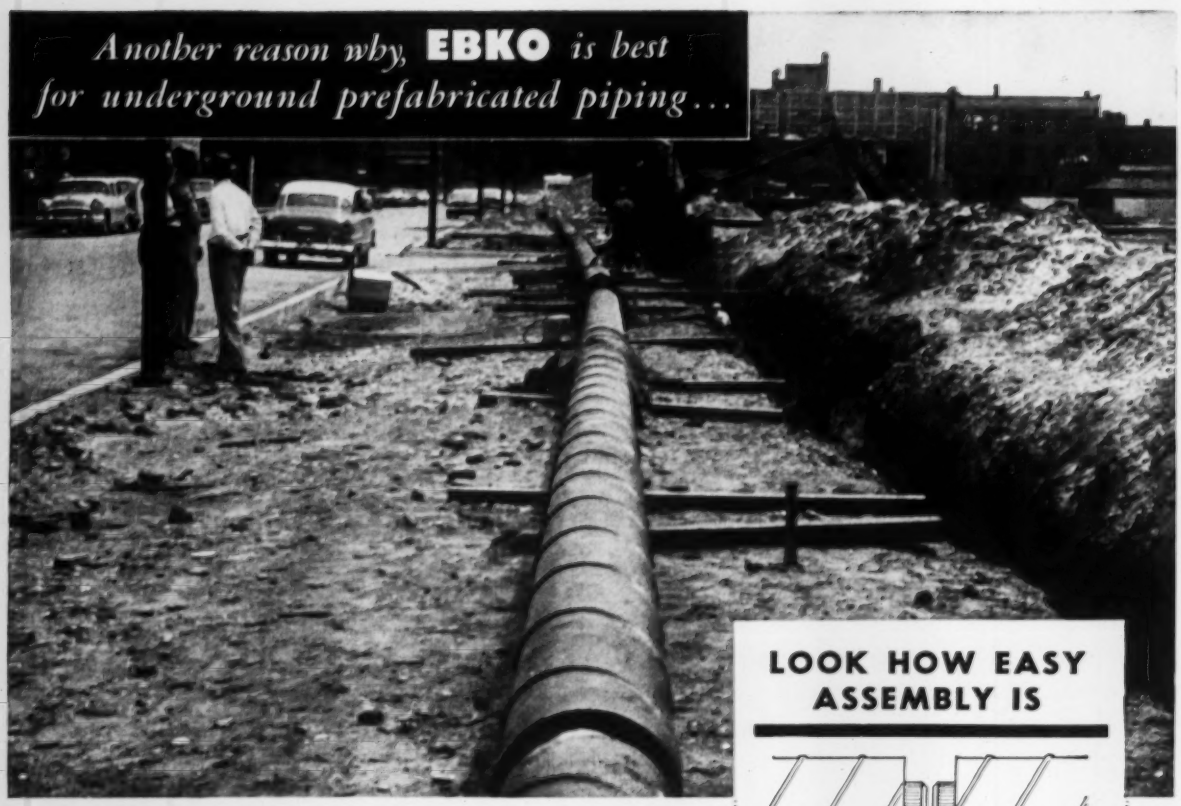
If you'd like other interesting examples proving the outstanding service advantages of I-R Motorpumps, get in touch with your nearby Ingersoll-Rand representative or write to Ingersoll-Rand, Cameron Div., 11 Broadway, New York 4, N. Y.

Ingersoll-Rand

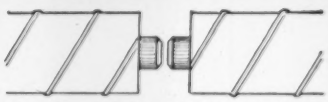
9-408

PUMPS CONDENSERS TURBO-BLOWERS COMPRESSORS ROCK DRILLS
VACUUM EQUIPMENT AIR & ELECTRIC TOOLS

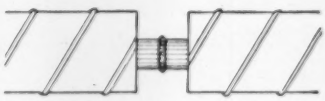
Another reason why, **EBKO** *is best for underground prefabricated piping...*



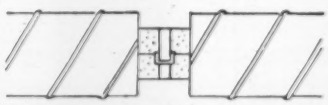
LOOK HOW EASY ASSEMBLY IS



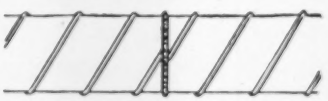
1. Place pipe on lubricated blocks beside the trench.



2. Align inner pipes, pull together, weld and then test for leaks.



3. Apply split insulation and band in place.



4. Pull casing together, weld and test.

EBKO systems are the easiest to install

A complete EBKO prefabricated insulated underground piping system can be installed in less time and with less work than other prefabricated systems. Here's why:

A plan layout accompanies every system with all pipe, fittings and accessories plainly marked. All parts are shipped in the order of their installation. Beside-the-trench-assembly and 14 gauge *minimum* steel casing strength eliminates necessity for wide or deep trenches. Note on right, simple assembly requires only welding and application of insulation and the welders work upright for the majority of welds.

. . . and remember, *only* EBKO provides steel casing with the Ebko-lok® seam that imparts further crush resistant strength to the casing for positive impact protection.

See your local EBKO Representative—let him show you *all* the reasons for EBKO's superiority or write for details — no obligation.

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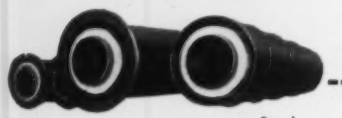

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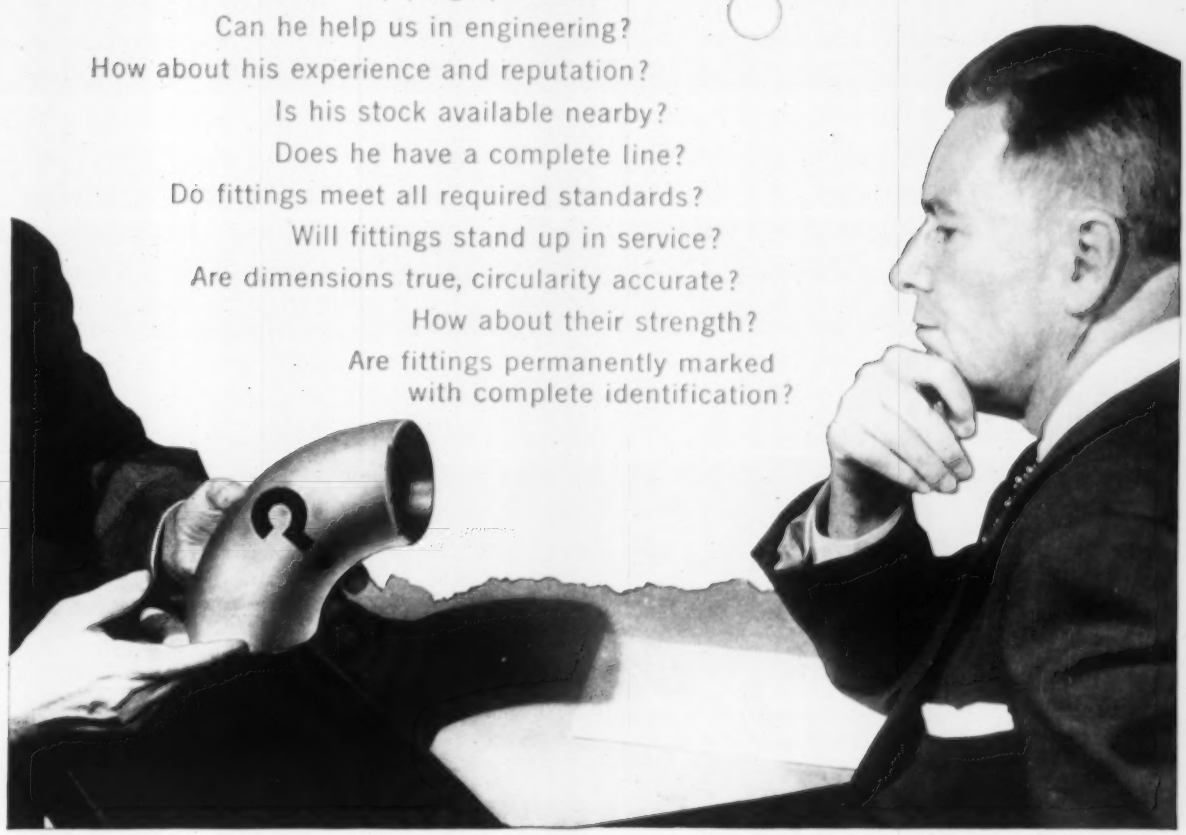
Is his stock available nearby?
Does he have a complete line?
Do fittings meet all required standards?
Will fittings stand up in service?
Are dimensions true, circularity accurate?
How about their strength?
Are fittings permanently marked with complete identification?



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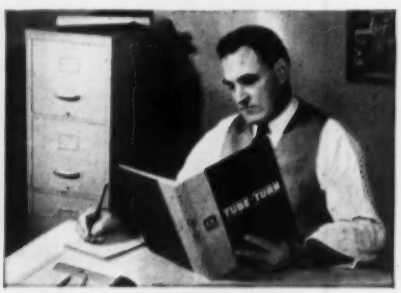

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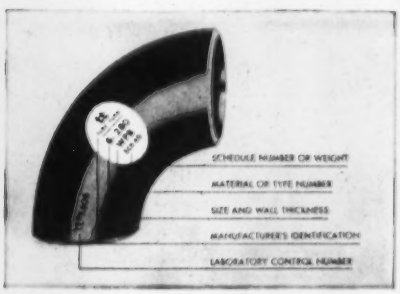

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After applying an adhesive to the panel, the pre-cut Pittsburgh Fiber Glass insulation is easily slipped into place. Half-inch Superfine with a .0007 aluminum facing is being used.

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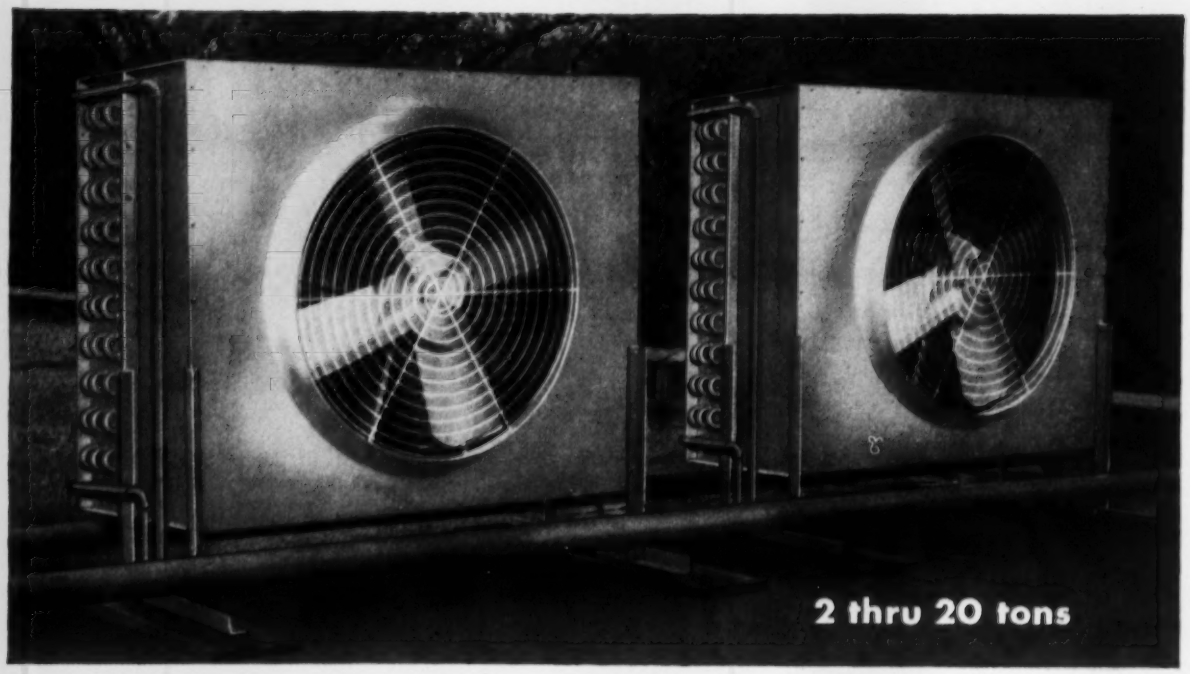
"LET'S GIVE THIS INDUSTRY A BETTER AIR-COOLED CONDENSER"



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4. Extra-Easy Multi-Circuiting—developed for Halstead & Mitchell remote Air-Cooled Condensers by engineers who know what simpler manifolding and selection of circuits can mean when several air conditioning and refrigeration machines must work off a single coil.

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World's Largest Manufacturer of WATER-COOLED, CLEANABLE CONDENSERS

Practical Data on Air Distribution

Prepared by the Engineering Department of Tuttle & Bailey, New Britain, Connecticut

Selecting the Right Equipment

As a service to those responsible for specifying air distribution equipment, Tuttle & Bailey will publish a series of technical articles on this all-important phase of heating, ventilating, and air conditioning systems. It is hoped these articles will be of help to the newcomers in the field and serve as "refresher" information for others.

Complaints arising from faulty air distribution are usually caused by drafts or stuffiness. These uncomfortable sensations are the result of one or more factors: temperature stratification, fluctuating gusts of air, warm or cold spots, or incorrect residual velocities. To obtain the correct residual velocities, and to eliminate spotty and gusty distribution, equipment first must be selected on the basis of its induction characteristics. In addition, we must know the effective area of the equipment selected.

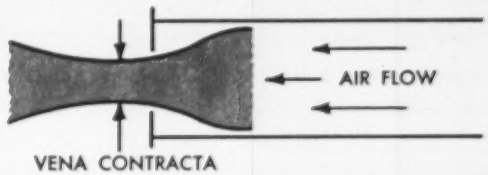
Induction Characteristics

Induction is simply the mixing of supply air and room air above the six foot (occupied) zone, in the room. The various types of air distribution devices available differ widely in the rapidity in which induction takes place. (See table below.)

Ceiling height and type of occupancy must be considered but generally the determining factor in selecting one type of device over another should be by comparison of induction characteristics. It is accepted that the higher the CFM per sq. ft. of area to be conditioned, the higher the induction rate of the device should be.

Effective Area

The performance of an air distribution outlet and the pressure calculations involving it are predicated upon its effective area. What this means can best be illustrated by a sharp-edge orifice located at the end of a duct. As the air approaches the orifice, it assumes a stream shape which at some point in its travel is smaller than the aperture through which it passes. This area is called the "vena contracta" — or the effective area of the orifice.



The same fact applies to an air distribution device. Air does not completely fill the passages of a diffuser — or between the bars of a grille — and at some point

Type	Mounting	Induction
Rectangular or linear diffuser	On ceiling	Low
Straight flow grille	In sidewall at ceiling	Low
Straight flow grille	In sidewall below ceiling	Low
Side deflection grille	In sidewall at ceiling	Medium
Half-round ceiling diffuser	In ceiling	Medium
Full-round ceiling diffuser	In ceiling	High
Full-round ceiling diffuser	Located down from ceiling	High

within the passages, a vena contracta exists. The sum of these vena contracta areas is the effective area of the outlet. Although the shape, size, and number of rings or bars of the device will influence the effective area and the location of the vena contracta areas, the principle applies regardless of design.

Application of Effective Area

The most important use of the effective area of an air outlet is to predict its throw. "Throw" is the distance or radius in feet that an air stream travels from its point of discharge to a point at which its velocity falls to a predetermined value. The velocity of the stream at the selected point determines the residual velocity, or the velocity of air in the occupied zone.

For ceiling diffusers, the throw can be determined by:

$$T = \frac{K \times CFM}{\sqrt{A_e}}$$

where: T = The distance in feet the air stream travels to a point at which its motion falls to a predetermined value

CFM = The cubic feet of air per minute

K = A constant determined by test and based on the induction characteristics of the diffuser

A_e = Effective area of the outlet in sq. ft.

"K" Values for Diffusers Discharging 360° Circular Air Pattern

Terminal Velocity	Average Residual Velocity	Flush Ceiling Mounting	Exposed Mounting
100 FPM	25-40 FPM	.0120	.0080
150 FPM	40-60 FPM	.0100	.0066
200 FPM	60-85 FPM	.0075	.0050

As with ceiling diffusers the effective area of grilles and registers must be known to predict their performance. Although ceiling diffusers usually have a fixed effective area, adjustable bar grilles and registers have an infinite number of effective areas depending upon their deflection settings.

To determine the distance an adjustable bar grille or register will throw:

$$T = \frac{K \times CFM}{\sqrt{A_e}}$$

where: T = Throw in feet

K = A constant determined by test and based on the deflection setting of the bars

CFM = Cubic feet of air per minute

*A_e = Core area in square inches

"K" Values for Adjustable Bar Grilles and Registers

Angle of Deflection	"K" Values
Straight	.80
22°-0°-22°	.68
42°-22°-0°-22°-42°	.55
55°-42°-22°-0°-22°-42°-55°	.43

*It should be noted that the throw formula differs from the one for ceiling diffusers in that it includes the term "core area" which relates the effective area of the grille to its catalogued size.

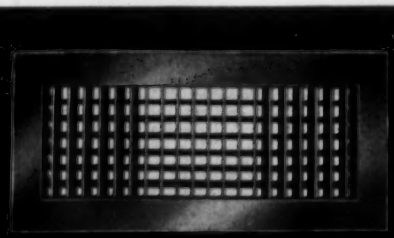
A terminal velocity of 50 FPM is used when selecting grilles because of their lower induction characteristic. This produces a residual velocity of 25-40 FPM.

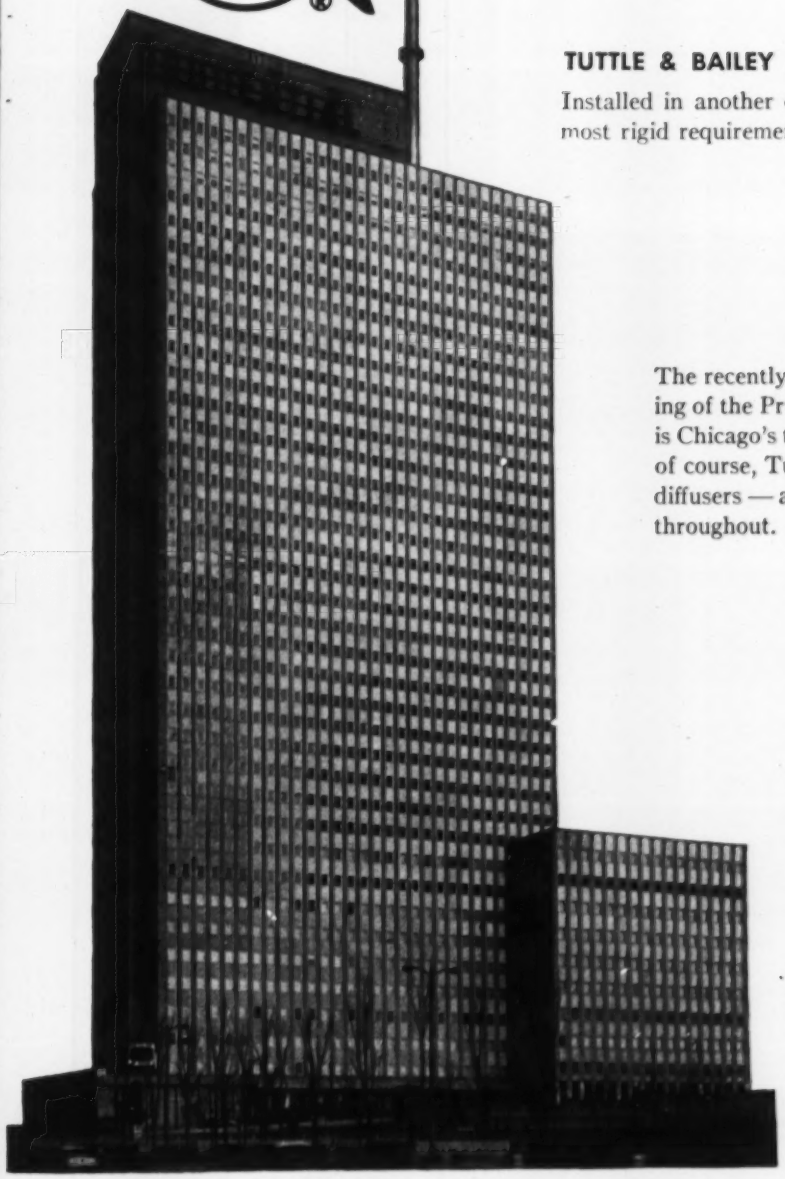
Conclusions:

1. Select an air distribution device with the right induction characteristic.
2. Know the effective area of the device you select.
3. Determine the right terminal and residual velocities and select the throw of the device to obtain them.

This is the first in the series of these technical articles. In months to come, subjects will cover specific problems encountered in the field.

If you have a specific problem involving air distribution, Tuttle & Bailey's Engineering Department will welcome the opportunity to be of help. Address: R. D. Tutt, Chief Engineer, Tuttle & Bailey, New Britain, Connecticut.





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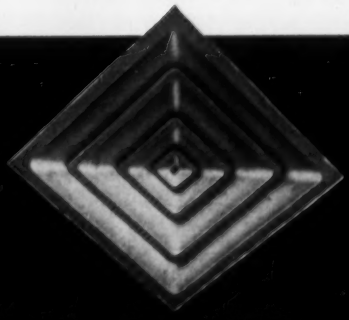

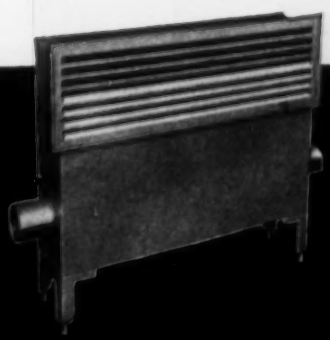

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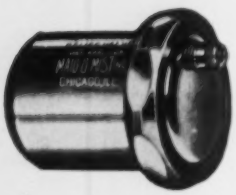

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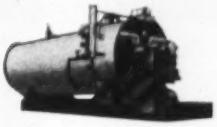

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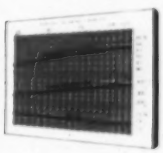

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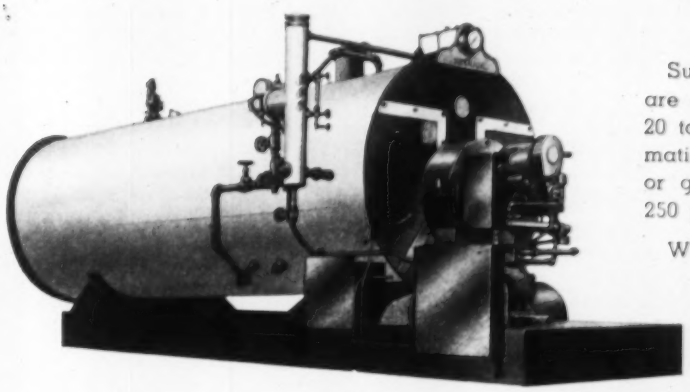

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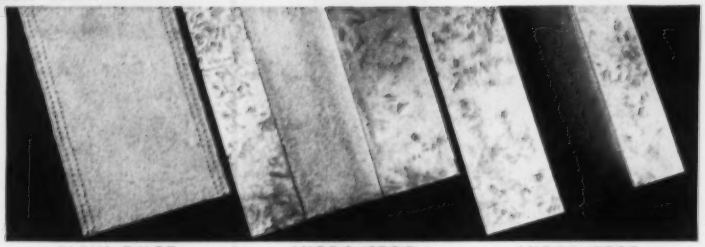
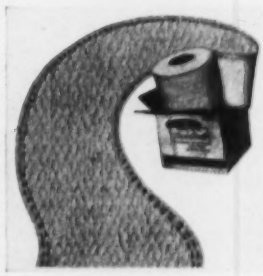


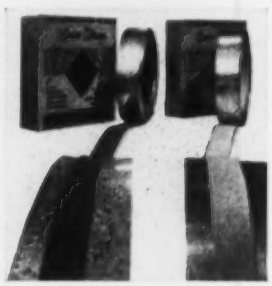
FLEXI-DUCT | VIBRA-STOP (Asbestos) | VIBRA-STOP (Canvas)

Check the *Quality Features* of these Grant Wilson Products



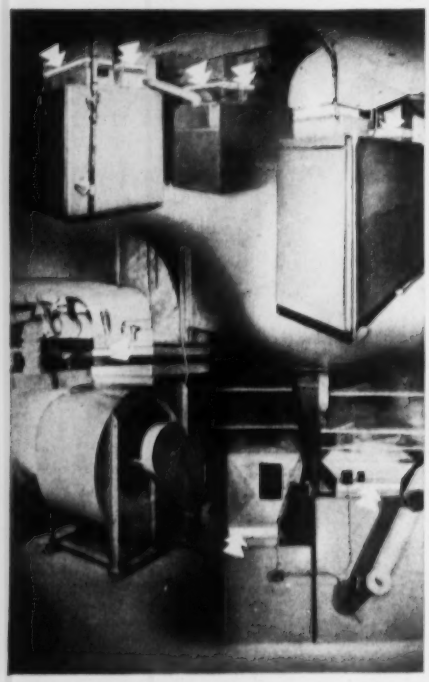
Flexi-Duct

...Woven Asbestos Flexible Tape. (Underwriters' Grade). Meets recommendations of National Board of Fire Underwriters. Comes in 6-inch, 50 foot rolls and 8-inch, 150 foot rolls, both with selvaged edges. Can be taped, bolted or otherwise easily and permanently secured to equipment or ductwork.



Vibra-Stop

...Asbestos or Canvas fabric, 4" wide, factory "Punch-Lock" sealed to 4-inch No. 1 Prime galvanized metal on one side, 3-inch on the other. Asbestos used is heavy Underwriters' Grade and meets Fed. Spec. MIL-C-4177. Canvas, also Underwriters' Grade, meets Fed. Spec. MIL-D-10860. 25 foot, 50 foot and 100 foot rolls in handy "roll out" cartons.



Composite photo shows typical installations of FLEXI-DUCT and both types of VIBRA-STOP.

SEE YOUR JOBBER... OR WRITE DIRECT FOR SAMPLES

Grant Wilson inc.

ASBESTOS and INSULATING MATERIALS

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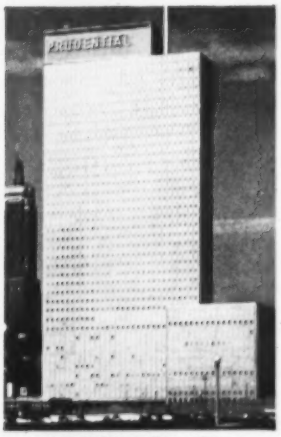

Prudential Building—Chicago, Illinois
Architects & Engineers—Naess & Murphy, Chicago
General Contractors—G. A. Fuller Co., Chicago
Plumbing Contractor—M. J. Corboy, Chicago

Hot Water Insurance by **RECO** in Prudential's Mid-America Home Office

The Prudential Insurance Co. wanted plenty of hot service water for its new 41-story Mid-America Home Office Building. RECO handled the job.

Five RECO copper-lined hot water storage heaters keep 8000 gallons of rust-free hot water on tap for all 41 floors.

RECO can offer *you* this same hot water insurance. *Plus* the RECO guarantee of top quality, competitive price, dependable performance and quick delivery. Rely on RECO's *full* line of heat exchangers. For all your hot water needs—SPECIFY RECO.

RECOgnized for superior quality in 48 states and 16 foreign countries.

RECOmmended by leading engineers, contractors and architects.

RECO Hot Water Storage Heaters, Convertors and Instantaneous Heaters.

For free catalogs and the name of the RECO Representative nearest you, write:

Richmond Engineering Co., Inc., Dept. D,
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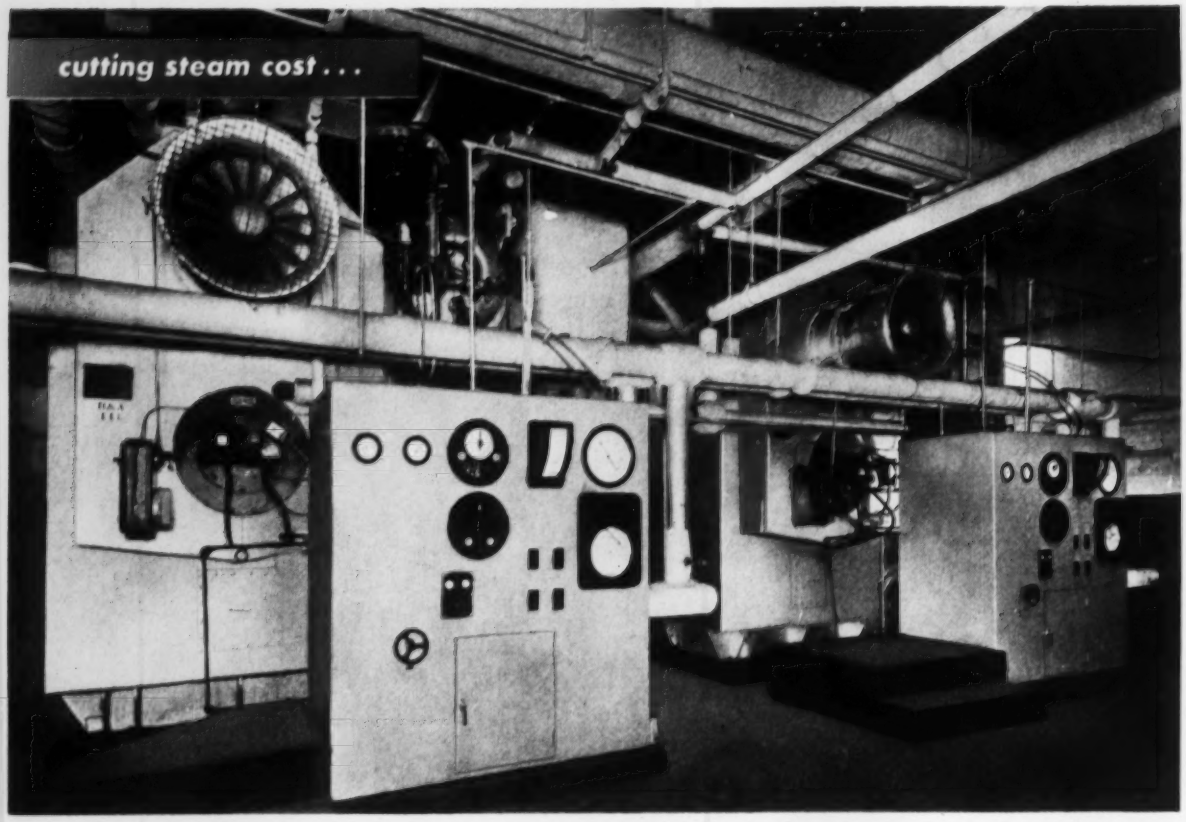
Richmond Engineering CO., Inc.



—B&W FM Boilers *are workin' for the railroad...*

At the New York Central Railroad Station in Springfield, Mass., two B&W Integral-Furnace Boilers, Type FM have earned their reputation for being "good steamers all right" during the past two years. The units have been in service since September 1953, with time out each year during the slack summer load.

Springfield Station contains a sizeable area and handles a moderately heavy traffic load in both trains and people. Steam produced by the FMs is utilized, in season, to heat cars, station, and a warehouse almost a mile away, supply hot water for all purposes, and meet requirements of the restaurant and barber shop.

Usually operated at about 150 psi, each FM unit is designed to generate 20,000 lb. of steam per hr. During heavy winter load periods both boilers are operated. However, when the heating load is not the major factor, one unit carries the load, which averages around 12,000 lb per hr.

Fully automatic operation, with fuel-air ratio control, provides ready response and efficient combustion for fuel savings and smoke control.

Here in Springfield, as in many other installations of all kinds—for power, processing and heating, for institutions, utilities, industries, and commercial establishments—B&W Boilers are effectively demonstrating their versatility and suitability for a wide variety of applications. The FM Boiler is available in standard sizes to 40,000 lb steam per hr at pressures to 235 psi and many are in service at higher pressures and with moderate superheat. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

COST-SAVING FEATURES

- Saves Erection Time and Cost
- Meets Wide Range of Service
- Handles Quick Load Changes
- Fast Steaming
- Low Maintenance
- Easy Accessibility
- Burns Oil and/or Gas
- Saves Fuel
- Saves Space
- Safe, Automatic Operation

BABCOCK & WILCOX

BOILER DIVISION

G-721

New Construction Outsizzles Forecasts

. . . as industry splurges on plant and equipment

NEW CONSTRUCTION in 1956 not only maintained its sizzling 1955 pace into the first quarter of this year but exceeded the predictions of even the most confirmed optimists. And experts say there is no sign of a letup.

Earlier estimates of a $44 billion peak this year are being revised upward by some industry experts.

Key factor: industry's plant and equipment spending, which the government now estimates will reach $35 billion, $1.6 billion more than experts saw five months ago.

Says George Cline Smith, F. W. Dodge Corp. economist, "What looked like a peak in 1955 now seems to be just a camp site on a climb to a whole new mountain range."

All segments of the construction industry — industrial, commercial, public utilities and residential—have been going strong this year.

Watch for minor interruptions in some segments—office buildings, for example—in case of a steel strike this summer. ‡

Chicago Hotels Rush to Complete Air Conditioning

. . . $50 million boom under way

CHICAGO HOTELS are in the midst of an air conditioning boom which will involve $50 million before their job is completed, according to W. T. Cove, hotel industry manager for the Minneapolis-Honeywell Regulator Co.

"Four major Chicago hotels already are installing complete central air conditioning systems," he said.

The Drake is completing its air conditioning program by making installations in the final unit of 130 rooms. (See article in February 1955 HPAC on The Drake installation.) The Conrad Hilton, Palmer House, and Sheraton-Blackstone also have air conditioning programs under way.

The Edgewater Beach is making test installations, and the LaSalle also is planning to launch an air conditioning program.

Speaking at the recent Midwest international hotel show, he said that three factors have contributed to the swing to complete hotel air conditioning:

- The public has grown accustomed to air conditioning in offices, stores, restaurants, and even homes and has come to expect that hotel rooms will be equally cool.
- Enginering advances have made it possible to install air conditioning in existing buildings, with individual room control, and to have it operate without distracting noise.
- Summers are getting hotter. ‡

Smog Red, Smog Green? New Network Alerts L.A.

. . . samples air pollution around clock

A NETWORK of 15 air monitoring stations recently established in the Los Angeles basin was ready for action at the start of the 1956 smog season, May 1st, according to the Air Pollution Control District. Established by the district for around the clock air sampling, the network marks the first time anywhere that the lower atmosphere has been investigated on such a broad scale with a continued surveillance of pollution levels.

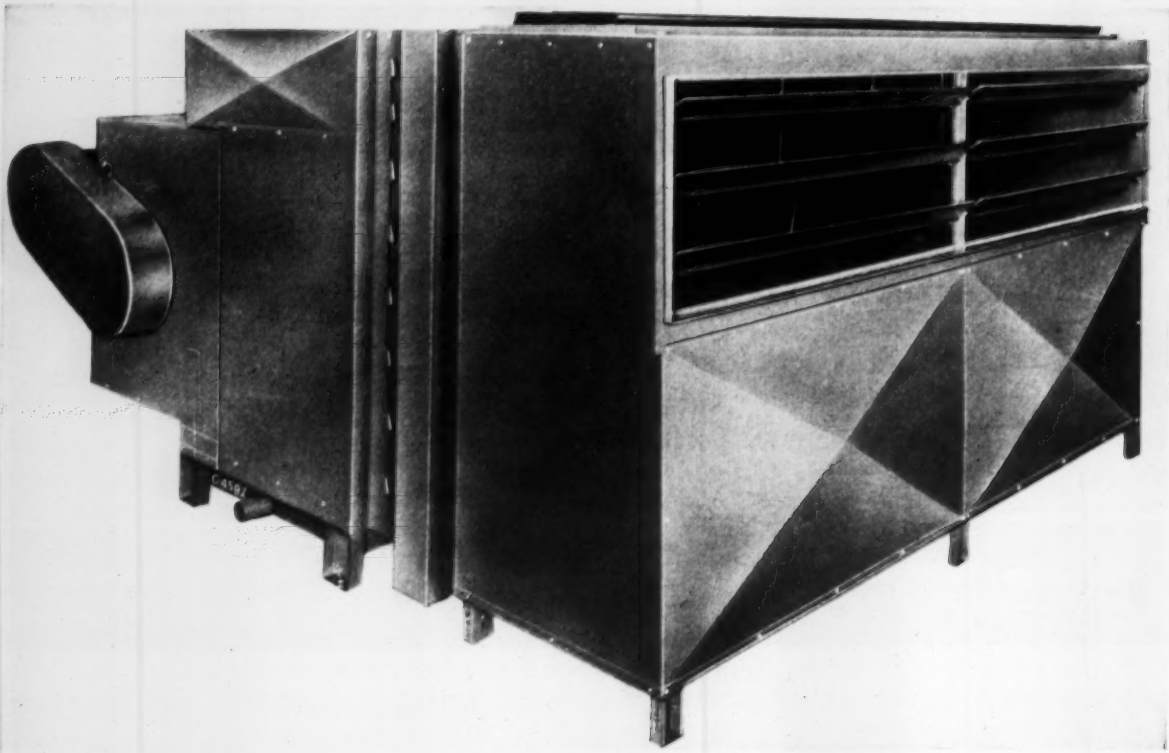
At each station automatic measuring instruments continuously record key pollutants, including sulfur oxides, nitrogen oxides, carbon monoxide, ozone, particulate matter, hy-

(Continued on page 86)

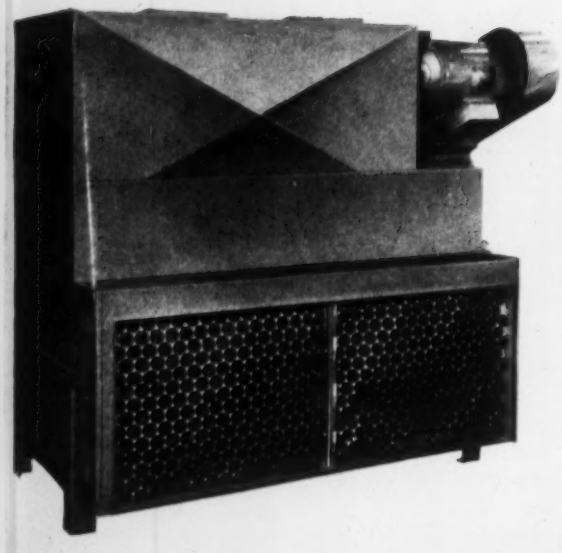
Air Condition Arizona's First Drive-in Bank

ROOM AIR CONDITIONERS installed through the wall in four teller stations of the motor branch of the Valley National bank, Phoenix, Ariz., provide year 'round comfort for cashiers. Each teller can select any one of six combinations of cooling, heating, dehumidification, and ventilation by adjusting the unit's single glider control which automatically switches the damper, compressors, and fans. A heating coil prevents chilling during the late evening, according to Amana Refrigeration, Inc. ‡

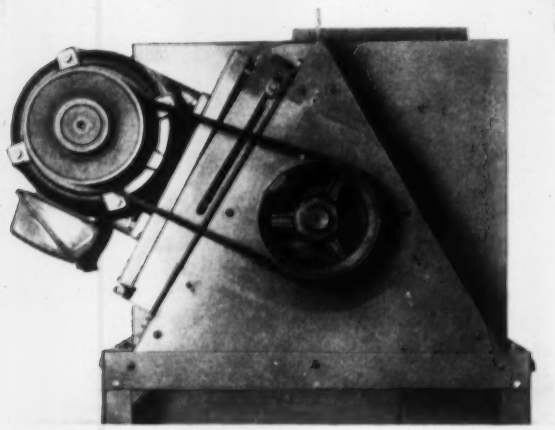
Announcing Worthington's



HORIZONTAL CONSTRUCTION of new Worthington air handling units allow them to be suspended from platform or ceiling (with hanger lugs.) Here is a large sized unit with damper section. Standard unit consists of fan section, fans, V-belt, drive (with variable pitch pulley), bypass and damper section, direct expansion or chilled water coils, and base section.



SMALLER SIZED UNITS are shipped completely assembled for horizontal or vertical arrangement shown above.



ADJUSTABLE MOTOR BASE, exclusive with Worthington, offers a 3½" variation in center distance. Adjusted with a single screw, a locking bolt secures base in proper position. This feature assures positive adjustment, enables you to keep belt tension correct. Belt turns on an adjustable pitch pulley which permits variation of fan speed and air quantity.

complete new line of flexible air conditioning units

Compact units—from 1½ to 106 tons—are easy to install—have many exclusive features

Here's a new line of unusually compact air conditioning units for commercial and industrial use in conjunction with central system air conditioning.

Designed by Worthington for easy installation, the standard unit consists of a base section, fan section and coil section. A bypass and damper section can be bolted directly to the coil face at the factory if desired, adding no height to the unit.

Units are extremely flexible. The fan section may be mounted with front, top or rear discharge. You can adjust speed for desired capacity and static pressures. Adjustable motor base offers 3½" variation in center distance for positive adjustment of belt tension. The motor mounts on the front, top, back or either end. Accessories are interchangeable between horizontal and vertical units.

Engineered by Worthington for long, trouble-free life, all sections are constructed of rugged fabricated steel, Bonderized and coated with a corrosion resistant enamel. Dynamically balanced, forward curved fans give maximum efficiency, quiet operation. (Fan shaft rides on lubricated-for-life bearings.)

For more facts on this new line of air conditioning equipment, write Worthington Corporation, Air Conditioning and Refrigeration Division, Section A-6.75-HP, Harrison, N. J.

These features add up to flexibility

- **Exclusive** adjustable motor base assures simple, positive adjustment of belt tension.
- **Motor mounts** on front, back or either end of unit.
- **Fan discharge** can be front, top or rear, as you prefer.
- **Accessories interchangeable** between the horizontal and vertical units.

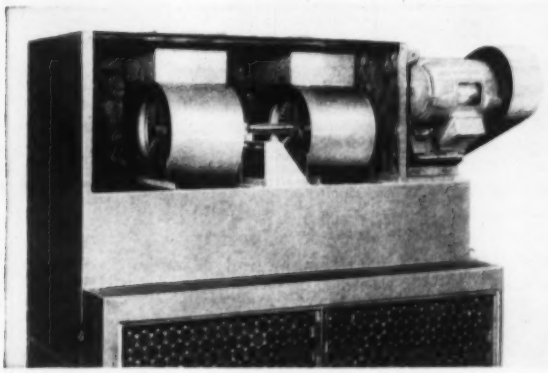
And look at these extras!

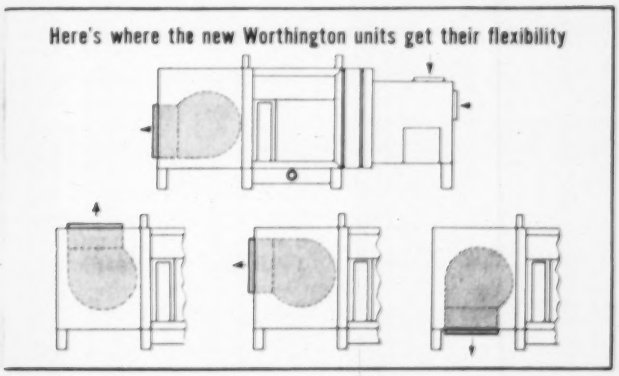
- **Up to 19,000 CFM!** You get more capacity from compact units.
- **Easy installation.** Choose either horizontal or vertical units.
- **Up to 81 different coil** combinations.
- **Lubricated-for-life** fan shaft ball bearings.
- **Accessibility!** Entire fan section can be easily removed. Removable panels and casings simplify inspection and adjustment.

A-6.75

WORTHINGTON

CLIMATE ENGINEERS TO INDUSTRY, BUSINESS AND THE HOME





ADJUSTABLE DISCHARGE. Fan section may be mounted with top discharge as shown above. Or discharge may be directed to front or rear of the unit. See diagrams.

(Continued from page 83)

drocarbons, ether soluble aerosols, and "total oxidant." The latter indicates the net oxidizing effect of the air after deduction has been made of any reducing agents or effects.

Pollution levels at the outlying stations are transmitted via a telemetering direct wire for automatic recording at the central station.

A mobile laboratory is used for special air sampling throughout the area, and other temporary stations are frequently set up.

Supplementing the network are 17 plant observation stations and 65 weather stations, whose reports are correlated in the daily smog forecasts.

From data collected, control measures will be studied, leading to zoning of districts to prevent the concentration of pollution sources. ‡

Nonresidential Building Code Goes into Effect

. . . In New York State

NEW YORK STATE'S new building construction code applicable to commercial, industrial, institutional, and other nonresidential building construction went into effect May 1 in the 181 municipalities which had already accepted applicability of the code on a voluntary basis by local legislative action, according to the state building code commission.

"The availability of complete uniform building regulations to all municipalities of the state desiring them is an important step in bringing order out of the chaos which has attended local building code enforcement in this state for half a century," stated Brig. Gen. Edward J. McGrew, Jr., chairman of the commission.

"The code is prepared in performance terms which are sufficiently broad to allow for admission of new techniques and materials without requiring constant amendment of the regulations themselves," he said.

A manual details typical permissive methods of meeting the code requirements. The commission has also published a list of generally accepted engineering standards under which construction, except where modified by detailed regulations in the code, is deemed to meet code requirements. ‡

Packaged Atomic Boiler Just Around the Corner

. . . manufacturer cites factors

A PACKAGED, atom fired boiler that will produce economical steam, heat, and hot water for industry may be only a few years away, according to Frederick H. Klein, president of Orr & Sembower, Inc.

"Now that the government is moving ahead with the design of packaged atomic power for planes and ships and increasing the availability of atomic energy to industry, we expect the atom powered boiler to emerge quickly from the drawing board to industrial applications," he says.

A packaged atomic power boiler would eventually make possible the cheapest heat in the form of steam and hot water that man has ever utilized, he said. "First cost would probably be higher than today's boiler of comparable capacity. But fuel costs, on the average, would eventually be very low."

The principle of operation, he explains, is similar to the modern packaged automatic boiler. The big difference is in the source of power, the necessary shielding, and the type of heat exchanger. The power source will be a small atomic pile, well shielded to prevent escape of harmful radiation. Control rods will maintain a desired rate of atomic fission.

The heat thus produced by the atomic reaction will generate steam from a boiler which is connected with the power pack.

"Though the theory is simple, there are of course a great many practical details to be worked out. However, this problem is similar in many ways to the one faced by designers of atomic power plants for ships and planes. But we won't have such tight weight and space limits."

It is not difficult for Mr. Klein to imagine packaged boilers powered by atomic fuel. Pointing out that the industry has applied coal, oil, natural gas, he explains that the economics and the natural availability of different fuels help industry to make up it mind. ‡

Robert C. Doremus Dies; Engineer, Author, Editor

. . . a member of HPAC's board

ROBERT C. DOREMUS, member of HPAC's board of consulting and contributing editors and chief engineer and secretary of the Detroit Ice Machine Co., died of heart failure in Detroit March 18, 1956. He was 65.

As a member of the National Association of Practical Refrigerating Engineers, he served many years in various offices. He was a past president and educational director of the Detroit chapter and a member of the national educational committee of the association.

Mr. Doremus also was past secretary of the Detroit section of the American Society of Refrigerating Engineers and belonged to several other clubs and societies.

He was the author of many technical papers and articles.

Friends throughout the country regret his passing. ‡

"Quote"

"Chief among the woes of the engineer is the writing of specifications."—*Kenneth M. Wilson, chief, electrical and mechanical engineering division, E. F. Klingler & Associates, Architects, in a recent speech before the Illinois chapter of the American Society of Heating and Air-Conditioning Engineers.*

INSIDE STORY:

Why a Heat Exchanger Poses for an X-ray

This technician is giving a clean bill of health to a completed weld on a P-K heat exchanger. Like the x-ray of your chest, this x-ray picture is designed to pick up flaws before they have a chance to become harmful.

Pinholes, lamination, slag inclusions, and all other symptoms of failure are ruled out by this process, which is used to scrutinize the "inside" of *every weld*. Such radiographs are indispensible in manufacturing pressure vessels that will meet every test of time and use. Each x-ray is checked by a representative of the Hartford Steam Boiler Inspection and Insurance Company —for further insurance that every P-K heat exchanger meets or exceeds the rigid standards of the 1952 ASME Code for Unfired Pressure Vessels.

But weld x-rays at P-K represent only a *precaution*. They don't speak for the fact that all P-K welders are ASME qualified for a total of more than 50 types of welding procedures—meaning that the likelihood that flaws will occur at all is minimized. Nor can you see in an x-ray photo the incredibly careful design and calculation that goes into every P-K pressure vessel, to assure that it will be *thermally* and *physically* correct in every way.

Add this all-important knowledge of thermal design to P-K's fabricating and testing procedures, and you have what makes P-K heat transfer equipment different —and better—than all the rest.

Like proof? We'd be delighted to receive your inquiry. The Patterson-Kelley Co., Inc., 750 Burson Street, East Stroudsburg, Penna. Offices in principal cities.

PATTERSON KELLEY

Heat Exchangers • Convertors • Storage Water Heaters • Condensers • Water Chillers • Oil Heaters • and all types of heat transfer equipment

OCEAN AIR ELEMENTARY SCHOOL, CITY SCHOOL BOARD, NORFOLK, VIRGINIA

John A. Simpson, A.I.A.
Architect, Norfolk, Va.

Another new school saves money with the Nesbitt Series Wind-o-line System

The $600,000 Ocean Air Elementary School of Norfolk, Virginia, will have "the thermal environment most conducive to learning" because Architect John A. Simpson specified *heating and ventilating by Nesbitt.*

By designing for a zoned, two-pipe, forced-hot-water installation, the architect reduced costs with the Nesbitt Series Wind-o-line System. Mains and piping were simplified; night controls and approximately 1,000 lineal feet of pipe covering were eliminated.

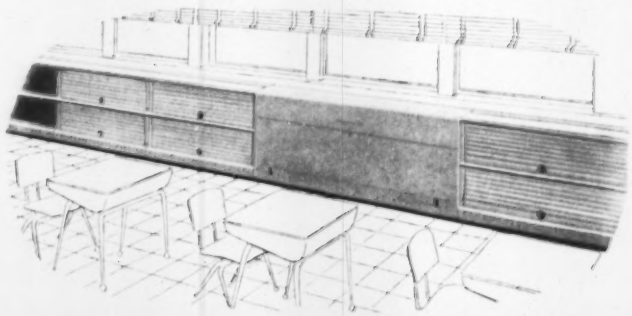
The key to the economy of the Nesbitt Series Wind-o-line System is the Syncretizer's hot water heating element which multipasses a much smaller quantity of higher temperature water than is circulated by conventional systems. This reduces the size of pipes and pumps and permits the Wind-o-line tubing to serve as supply and return piping for entire classroom wings, thus eliminating mains, costly pipe trenches, coverings, and runouts. Without other investment, the system's gravity heat maintains overnight temperatures.

Besides economy, the Nesbitt System offers greater comfort and protection. With the water temperature regulated by outdoor temperatures, the desired thermal environment is better maintained in every classroom and Wind-o-line protection along exposed surfaces is constantly related to actual needs.

Other systems requiring pipe trenches and runouts cost up to 20% more in construction, equipment and installation expenses. It will pay you to go Nesbitt.

Write today for Publication 104

Wind-o-line radiation may be had in wall-hung casings integrated with the Syncretizer, or recessed in standard Nesbitt storage cabinets. Architect Simpson chose this "Nesbitt Package" because it saved 30% over custom wood shelving.



Nesbitt

SERIES WIND·O·LINE SYSTEM

MADE AND SOLD BY JOHN J. NESBITT, INC., PHILADELPHIA 36, PA. SOLD ALSO BY AMERICAN BLOWER CORPORATION

"Open for Discussion"

• *WE FOLLOW HERE each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

Air Curtain Separates Conditioned and Unconditioned Rooms in Israel Factory

THE ARTICLE, *Air Curtain Seals a Door Opening*, in the January HPAC proved very interesting. In connection with it I should like to mention a local application of this principle.

Such a system for cooling was installed on a door opening separating two factory halls, one unconditioned and the other kept at 70 F. A sheet metal duct connects the floor grate to the overhead discharge outlets. In the upper horizontal part of the duct are connected one row of metal washable filters, a coil, and a centrifugal fan. The cooling coil together with the hall's air conditioning unit are connected to a common compressor unit. The fan is run at a constant speed since there are no variable wind velocities to overcome.

The overhead supply outlet is of the same construction as the floor grate and does not divide the air into vertical layers. The floor pit is not provided with water nozzles for cleaning but has several removable impingement plates which stop the heavier dust particles before they reach the filters. This of course increases the resistance to air flow but, on the other hand, simplifies the cleaning problem. The above system has been in operation for two years, and the results are very satisfactory.

BENJAMIN ISCOVITCSH
Air Conditioning Engineer
Tel Aviv, Israel

HPAC Readers Agree It's Better To Use Separate Heating System for Plant

IN HIS ANSWER to HPAC's April Question of the Month, *How Can Overhead Pipes Be Used to Heat Plant?*, Anton Nieberl actually discusses the installation of a radiant heating coil or panel instead of the utilization of waste heat from the overhead mains which run through the plant. His system, which amounts to a separate heating system, sounds good, and I believe it is very practical.

Another answer, by C. N. Mattioli, mentions the use of unit heaters in conjunction with an overhead radiant heating system to balance out infiltration and prevent cold air currents at the working level. I agree with Mr. Mattioli, incidentally, that his solution *C* is probably as close an approximation to the output of the radiant coil with reflectors as can be determined without actual experiments. This might prove to be slightly lower with exceptionally high ceilings.

Like Mr. Nieberl, Mr. Mattioli does not suggest using overhead process steam mains with reflectors directly over them but instead describes a separate heating system.

G. C. Monteath in another answer mentions using finned pipe sections for increased heating surface. This is equivalent to providing a separate heating system with radiators, coils, or radiant sections rather than merely placing the reflectors over the process mains. This would provide a more effective means of heating and would be one which could be properly regulated and controlled.

Thus, nearly all of the answers point out that a separate system for heating a plant would be more practical and economical. These answers confirm my analysis of this question in the November 1955 HPAC.

SHELDON R. HIGGINS
Mechanical Engineer

Central Station Piping Trends Indicate Need for Further Pipe Developments

REGARDING the article, *Is Central Station Progress Being Limited by Lack of Pipe?*, by Frank A. Ritchings and Sabin Crocker, in the April HPAC, here is a summary of my discussion comments on it given following the presentation of the original paper at the recent American Power Conference.

The various techniques available for the manufacture of central station piping requirements, interestingly reviewed by the authors, indicate that further developments in high pressure, high temperature piping should be encouraged.

The authors confine their consideration to the ferritic steels since these predominate in central station piping. Yet the problem of using austenitic steels seems inextricably involved where service temperatures are above 1050 F. Thus, it seems to me, that the art of making satisfactory austenitic pipes, which is highly exacting, also needs further development and encouragement.

The authors discuss centrifugally cast pipe, which has not come into use despite much discussion in the past decade. I believe it deserves consideration as an additional source of material, particularly as an alter-

native during an emergency when all of the various wrought pipe facilities might become heavily committed. Aside from economics, no reasonable technologies for heavy pipe production should go undeveloped.

With this viewpoint, a demonstration of centrifugally cast ferritic steel as power piping was undertaken jointly by the American Cast Iron Pipe Co., the Commonwealth Edison Co., and Crane Co. Lengths up to 16 ft, with 2⅛ in. wall thickness, to which the authors refer, were used in this project. The pipe size 12¾ in. OD with the 2⅛ in. wall thickness was chosen to be representative of the main steam piping used at Ridgeland station near Chicago for 2000 psig and 1050 F. The castings were made to the WC9 composition of American Society for Testing Materials A-217, having 2¼ percent chromium and 1 percent molybdenum, as used for valves. Two 16 ft lengths were welded into one 32 ft length, hot bent 90 deg, and then installed for thermal cycling, using 2000 psig and 1050 F steam.

Upon radiography, magnetic particle, and ultrasonic inspections of the first castings made at Birmingham, Ala., it was determined that an increased allowance for cleanup was desirable, particularly on the inside of the castings. Two further castings, made with about ¾ in. in extra section on the inside and ¼ in. on the outside for removal by machining, were deemed satisfactory. They were assembled at Chicago by welding with 2¼ percent chrome, 1 percent moly electrodes, using the inert gas shielding technique for the first pass. The top of the weld was machined flush with the outside surface of the pipe, and then the assembly was sand filled and bent hot 90 deg to a 6 ft, 8 in. radius, with the weld at the center of the bend. The cast assembly withstood the bending with no objectionable defects on either the inside or the outside.

The bend was then installed at Ridgeland station for a program of thermal cycling exposures under steam pressure and temperature. Unfortunately, circumstances prevented the completion of the thermal cycling program and the installation was dismantled. The weld between the two castings as well as other sections of the assembly are currently undergoing further metallurgical study.

As far as the project has gone, it would seem that centrifugally cast ferritic steel is engineeringly feasible for high pressure, high temperature central station piping. If it is contemplated for straight runs of pipe only, instead of for the more difficult bend fabrication, its use might afford some economies over wrought steel equivalents because some of the preparations and precautions needed to insure bendability might be superfluous. In the case of fabrications requiring bending, while economy becomes a lesser advantage, the use of centrifugally cast ferritic steel certainly can be accomplished at a cost which is not out of line with that for the wrought equivalents.

J. J. Kanter
Crane Co.

Underdrainage for Conduit Insulation Necessary in Small Number of Jobs

We are greatly interested in the article *Provide Good Drainage, Pure Fill for Best Efficiency of Conduit Insulation*, by Samuel R. Lewis in the January HPAC. We are happy that Mr. Lewis prepared this article since he is such an engineering authority of known standing and integrity in the field.

The conclusion in the article, i.e., that all conduits need to be underdrained, is, it seems to us, advocating an added expense which is unnecessary in all but a minutely small percentage of jobs, or disregards some of the features of certain types of conduit structures, including ours. Our conduit systems as well as those of others do have an annular space between the conduit housing and the insulation, and it is very possible to completely dry any insulation that becomes wet for any reason, whatsoever.

Damage by the equipment of another contractor than the one responsible for the installation of the piping system is, of course, possible. Also, failure of interior piping, for any of several well-understood reasons, is possible. However, after repairs, introduction into the conduit and circulation of low pressure air between conduit and insulation quickly dries out the system. Corrosion is active only in the presence of moisture.

Clean, rock free backfill material, tamped as required by the engineer, and in accordance with individual soil conditions as he has determined them, are always wise and have always been a part of the recommended specifications of the conduit system manufacturers as well as applicable Federal Guide specifications and the specifications used by outstanding engineers in industrial and commercial applications.

Asphalt, as a waterproofing and corrosion resistant agent, is and has been an integral part of the conduit systems of more than one manufacturer for many years.

Mr. Lewis' feelings concerning the "single responsibility" contract for all parts of the work concerning the piping, insulation, and conduit system, have long been shared by many people intimate with this phase of the piping trade and would be well accepted by everyone involved.

W. F. Woon
General Sales Manager
Ric-wil, Inc.

Synthetic Fuel Analysis Intelligent and Reasonable, Though Some Won't Agree

The analysis of the future of synthetic fuels by H. R. Batchelder and H. W. Nelson, in the article, *Synthetic Fuel Production Must Begin Soon*, in the January HPAC, is, in my opinion, intelligent and reasonable.

Many will probably disagree with some particular

phase of their predictions, but this is an "occupational hazard" which forecasters must accept. Though many question the results of forecasts and though time often proves predictions to be not precisely correct, forecasts serve a useful purpose and should be made.

The important thing about this article, I believe, is that the authors have utilized the record of the past, plus a sensible interpretation of the physical limits that will prevail in the future, to arrive at a believable approximation of the future use of synthetic fuels.

Perhaps the point in their analysis which will bring forth the most controversy is their estimation of the time when petroleum and natural gas will reach peak production in this country. Since our knowledge of the ultimate reserves of oil and gas is much more limited than for other resources, it is extremely difficult to predict their production peaks. In fact, we will probably have passed the highest point before we fully realize it. Dire predictions of the decline of petroleum production have been wrong so many times in the past that we question the accuracy of any prediction for oil and gas. However, someday the prediction of the decline of oil will be right; perhaps this is the one. One variable not considered by Messrs. Batchelder and Nelson is the future of foreign petroleum imported into the U. S. If large supplies of low cost foreign oil are available and are permitted to enter the U. S., this could cause some delay in the appearance of synthetic fuels.

The potential of oil shales as a source of liquid fuels is certainly not as large as that of coal. However, oil shales do represent a reserve that may be as large as the ultimate reserve of crude oil, and they currently seem more attractive cost-wise than do synthetic fuels from coal. In view of this, the future of oil shales may be underestimated by the authors, with respect to time and quantity.

It is not quite clear to me why the "demand" curve cannot be plotted for natural gas, as the authors state. The production and use of oil—or any other fuel—is limited to the capacity of the distribution system for that fuel. The fact that most of our crude petroleum moves through pipe lines did not prevent the authors from plotting a "demand" curve for petroleum. Still, it must be admitted that the future of natural gas will probably be affected more by artificial regulatory activities than is the case with the other fossil fuels.

To predicate the future of synthetic fuels solely on what will be necessary to maintain our standard of living, eliminating from consideration the relative cost of these synthetic fuels, seems to me in direct opposition to the manner in which our fuel utilization has been determined in the past. Our use of fuels has always been based, not on which fuel is in the greatest supply, but what fuel will offer us the lowest cost energy, with some consideration for convenience and quality. This does not mean Messrs. Batchelder and Nelson are incorrect in their prediction. It is conceivable, because of the relationship between supply and price, that one may arrive at the same prediction whether one bases his calculations on comparative prices or on the abilities of the various fuels to satisfy the demand. It seems to me that as the supplies of oil and gas become unable to satisfy the domestic economy with liquid fuels, the prices will naturally rise. In turn, the large untapped sources of liquid fuels, oil shales and coal, will have to be used to satisfy the additional demand and will be able to do so at competitive costs.

JOHN J. SCHANZ, JR.
Assistant Professor of
Mineral Economics
The Pennsylvania State University

Timetable for Synthetic Fuel Production Not So Urgent as Article Indicates

REGARDING THE ARTICLE, *Synthetic Fuel Production Must Begin Soon*, by H. R. Batchelder and H. W. Nelson, in the January HPAC, I have no significant disagreement with the eventual need for synthetic production of gases from coal and/or oil shale. But I do disagree somewhat with the timetable specified in the article.

Although the article indicates that ultimate petroleum reserves are estimated at 120 billion barrels—four times the proved recoverable reserves at the present time—the article utilizes extremely conservative forecasts of ultimate reserves of natural gas. For instance, the article refers to DeGolyers' estimate of 400 trillion cu ft, which is quite out of date, and also refers to an early estimate by Lyon Terry of 500 trillion cu ft. Mr. Terry later revised his figures to "substantially in excess of 500 trillion cu ft." Howard Hinson's estimate is nearly 600 trillion cu ft.

The usual procedure for developing ultimate reserves of natural gas is to relate them to estimated oil reserves. If it is assumed that there is ultimately four times as much oil as is presently proven, then it seems likely that ultimate gas reserves will be at least four times the presently proven reserves of 211 trillion cu ft. As improved techniques permit deeper drilling — a trend which is currently discernible — gas-oil ratios increase under higher pressures so that there would be some justification for considering 840 trillion cu ft as the total remaining gas reserves, if the 120 billion bbl is accepted. Analysis of gas-oil ratios on new reserves discovered in postwar years leads to the same general conclusion. Under these circumstances, the ratio between reserves and production may approximate 20 to 25 in 1975, rather than the 10 quoted.

Also, our projections of natural gas production indicate a level of 14 trillion cu ft in 1975 rather than

the 17.3 postulated in the article. Using either of the production estimates, the ratio between reserves and production will be approximately 20 to 25 in 1975 rather than the 10 quoted.

The article indicates that a demand curve cannot be used for natural gas, as for other fossil fuels, because of limitations of capacity of the distribution system. The obvious inference, which is incorrect in my opinion, is that natural gas transmission and distribution construction cannot be expected to keep pace with the demand for this fuel, whereas oil refining and marketing facilities will keep pace by further expansion, thus justifying a "demand" curve approach for oil. The necessity for locating reserves of 2 trillion cu ft to justify the construction of new and economical long distance pipe lines, does not seem to be a limiting factor over the long term.

The statement that petroleum and natural gas reserves are "dwindling" may provide an incorrect implication unless it is clarified that this refers to the ultimate future rather than the immediate future.

The estimate that 25.5 barrels of oil will be used per capita in 1975 represents only a projection of the general energy consumption per capita applied to population growth; it does not reflect a continuation of the inter-fuel switching apparent in the accelerated postwar trend toward liquid and gaseous fuels.

Comments regarding a reduction in the use of gas as prices increase might be modified to reflect the relative permanency of use of many existing customers because of appliance investment and the probability that prices of other fuels will also trend upward, so that competitively the gas price increases will be less disadvantageous to consumers.

Finally, the pressure upon the natural resource and the need for synthetic fuels is expected to occur more promptly in remoter areas of the country, where natural gas is more expensive, compared to alternative fuels, and where the availability of large new sources of supply is not likely.

DANIEL PARSON
Director, Bureau of Standards
American Gas Association

THE AUTHORS' REPLY—We were interested to have the comments of Mr. Parson and Prof. Schanz regarding this paper and appreciate their interest.

Mr. Parson states that a figure of 840 trillion cu ft of natural gas is more realistic than the figure of about 600 trillion cu ft accepted in our paper. We have not seen estimates of that magnitude in the technical literature or we would have mentioned them. It is possible, of course, that future events will show that reserves can reach the level suggested by Mr. Parson.

Mr. Parson also suggests that the projected figure of 25.5 barrels of oil per capita in 1975 is too low. This was explained in our original paper, together with how this figure was obtained. Under the system of projection used, we would have no justification to use a higher figure.

HARLAN W. NELSON
Chief, Fuels Technology Div.,
Battelle Memorial Institute

Shortage of Examiners Retards Patent Applications; 3½ Years Behind

AMERICAN INDUSTRY is facing long delays in obtaining patent coverage for products and processes otherwise ready for the market. This was emphasized at a recent meeting of The New York Patent Law Association in an address by the Commissioner of Patents.

The flood of patents filed in the last few years has stretched the average prosecution time per patent to three and a half years.

The Patent Examiner thus holds a key position in the advancement of American technology, and the only way to reduce these delays and clear the way for marketing the new products and processes is to hire new Patent Examiners to pass upon the logjam of applications.

Patent Examiners pass upon applications for patents in a wide range of technical fields to determine whether they are novel and whether invention is involved. This calls for a study of the issued patents and the related scientific literature.

Engineers and scientists holding a college degree in engineering or applied science are eligible for appointment as Patent Examiners, without examination, upon application to the Commissioner of Patents in Washington, D. C. Salaries range from $4345 to $13,000 and above per year.

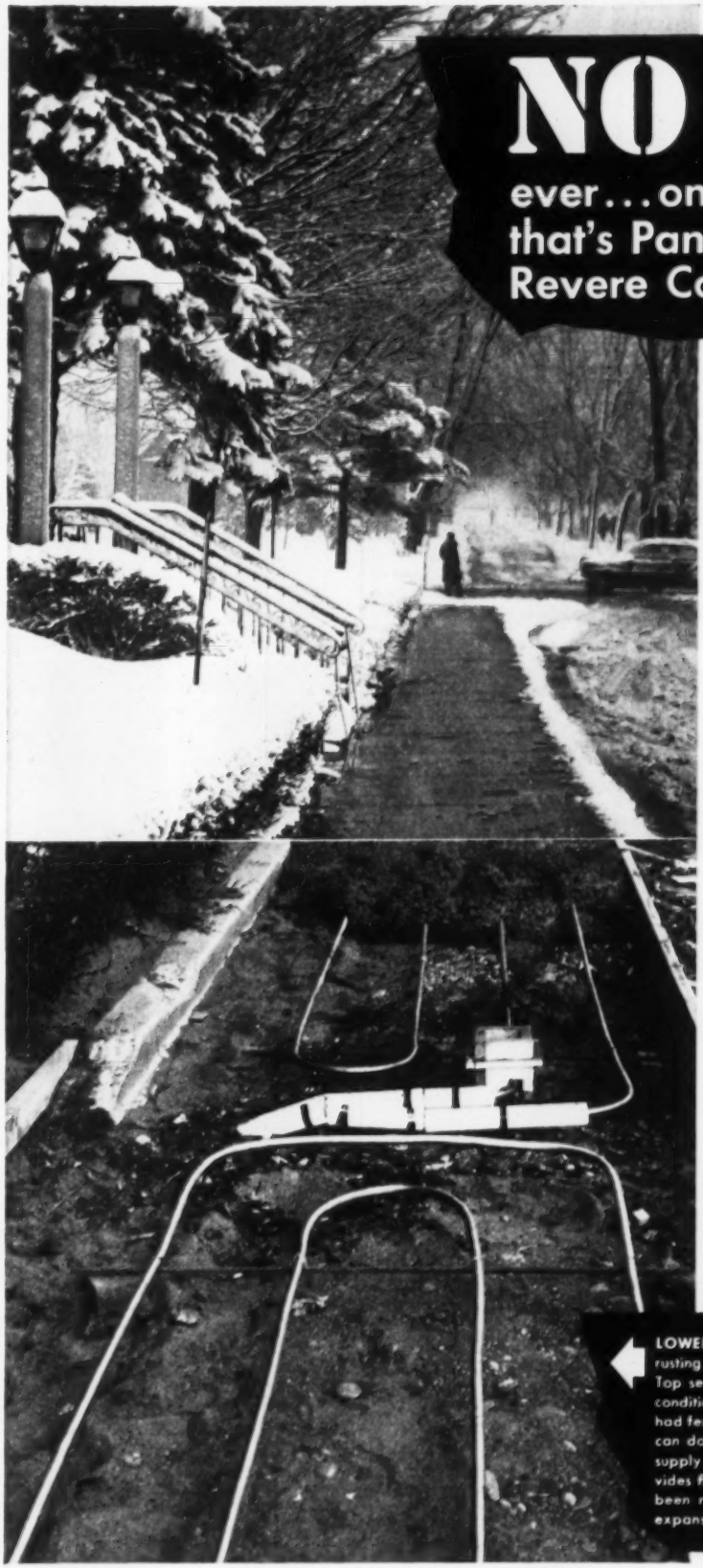
HENRY E. SHARPE
Vice-Chairman, Committee on Public Relations,
The New York Patent Law Association

Industrial Atomic Lab Piping Article Was Written by Four Co-workers

THE ARTICLE, *Piping Performs 16 Services for Industrial Atomic Laboratory*, in the February HPAC, by Richard W. Ulm, Walter J. Hamer, Lewis H. Rogers, and Gene P. Rutledge was based on work performed for the Atomic Energy Commission by Union Carbide Nuclear Co., a division of Union Carbide and Carbon Corp. at Oak Ridge, Tenn.

While Lewis H. Rogers is now with the Southern California Air Pollution Foundation and Gene P. Rutledge is with Goodyear Atomic Corp., the work was accomplished while all four of the authors were employees of Union Carbide Nuclear Co.

P. F. BLISS
Supervisor, Community Relations,
Goodyear Atomic Corp.



NO SNOW

ever...on the sidewalk that's Panel Heated with Revere Copper Water Tube

Huge strides are being made by this method of snow removal. No wonder, shoveling and accidents due to snowy walks are eliminated . . . while the time and labor saved pays for the installation in short order.

That's why you'll find snow melting panels also being used on driveways, loading platforms, entrance aprons, service stations, pedestrian ramps at railroad stations, airports and similar spots. One application which bears special mention is the use of coils in garages. They quickly melt the snow on cars, keep floors dry as well as keep the repair shop floors warm so mechanics can lie right on the bare concrete in comfort.

And when you make the panels of Revere Copper Water Tube you have these added advantages: Copper can be bent to conform to the terrain. Bendability permits use of sinuous coils, while the 60-foot lengths of tube mean fewer fittings which, when joined by solder means joints that stay tight. Copper tube cannot rust, rot or deteriorate. That's why, on the inside, full flow and low frictional resistance are maintained throughout its long life. While external moisture will not harm it from the outside.

Keep ahead of the parade. Recommend Panel Heating for snow removal. Revere's Technical Advisory Service will be glad to help you in the proper application of Revere Copper Tube in working up your plans.

FREE! Instructive 16mm Full Color Motion Picture, "The ABC of Radiant Panel Heating." Write Advertising Department for details.

REVERE

COPPER AND BRASS INCORPORATED

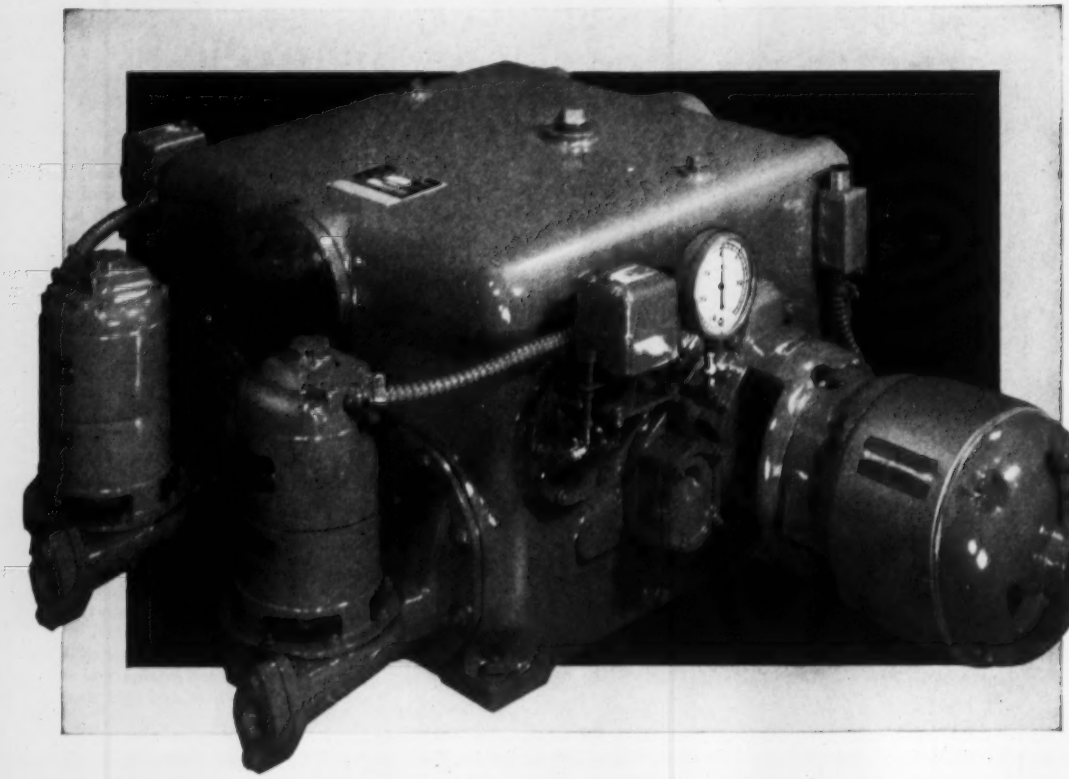
Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

Mills: Baltimore, Md.; Brooklyn, N. Y.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Newport, Ark.; Rome, N.Y.
Sales Offices in Principal Cities, Distributors Everywhere.

LOWER SECTION OF PHOTOGRAPH shows how non-rusting Revere Copper Tube was imbedded in concrete slab. Top section of photo shows same walk under actual snow conditions. Note bends. Think of all the joints necessary had ferrous pipe been used. And think, too, of what seepage can do to rustable materials. Note insulation used on each supply and return line to the coils from the mains. This provides flexibility in the take-offs from the mains, which have been run below the slab, to allow for movement due to expansion and contraction.

THIS·NEW VACUUM HEATING PUMP
IS SIZED TO ACTUAL JOB REQUIREMENTS



It's the Nash CSM

No longer is it necessary for the Engineer to accept a vacuum heating pump with air and water capacities based inflexibly upon square feet of equivalent direct radiation. With the flexible Nash CSM he can provide for proper air capacity in accordance with his judgment and experience. For the individual capacities of the separate pumps on the CSM may be varied within a wide range, without buying an oversize receiver and oversize water pumps.

These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low, returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- Increased air capacity induces rapid system response without wasteful overheating.
- Separate air and water pumps individually selected to meet actual job requirements.
- Control system that operates individual pumps only when needed.
- Flexibility permitting addition of radiation without changing basic pump installation.
- Low, low, return line connection.

NASH ENGINEERING COMPANY
438 WILSON, SO. NORWALK, CONN.

300 Ton Heat Pump System Air Conditions Office Building

Using water from a shallow and a deep well, a year 'round heat pump system of three 100 hp refrigeration compressors, two 150 ton chillers, and three 100 ton condensers combines radiant panel heating and cooling with a fan system in this modern Southwest building. The complete system was installed for about $1000 per ton, or less than $3 per sq ft of gross floor area.

NORTH-SOUTH ORIENTED, 12-story Simms building, Albuquerque, N. M., requires simultaneous heating and cooling even when outside temperature is 20 F

By Frank H. Bridgers and Donald D. Paxton

Bridgers & Paxton, Consulting Engineers

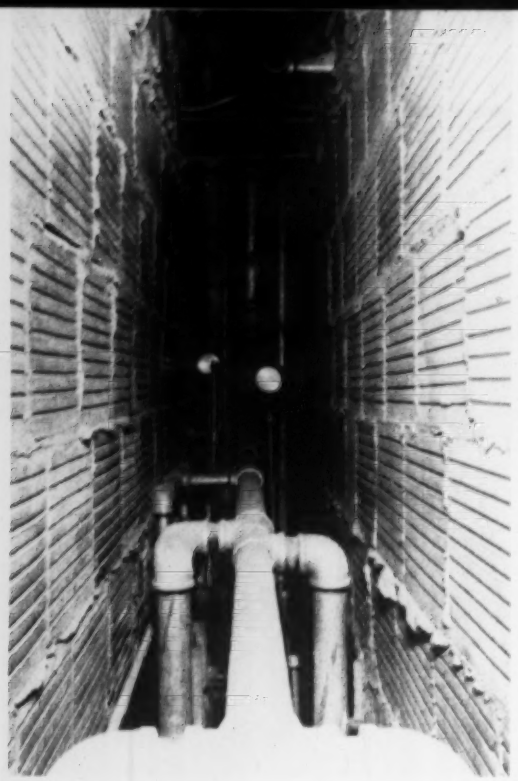
THE HEATING and air conditioning system for the 12-story Simms office building in Albuquerque, N. M., in operation since October 1954, has several interesting features.

Among them:

1) The building is completely heated by a heat pump system, consisting of three 100 hp compressors, two 150 ton water chillers, and three 100 ton condensers in connection with two deep wells from different water bearing strata — one 60 ft deep and the other 270 ft deep — from which 67 F ground water is available year 'round. There is no boiler or supplementary means of heating.

2) During summer operation, water is used from the 60 ft shallow well and dumped into the 270 ft deep well. This water is dumped at approximately 100 F off the condensers into the deep well, which heats the ground water and water bearing sands. During winter, water is pumped from the deep well, and 75 F water — in lieu of 67 F ground water — can be obtained for several months because of the heat dissipated during the cooling cycle. During heating, 55 F water off the evaporators is dumped into the shallow well. This provides means of obtaining lower than 67 F well water temperature during the cooling cycle. The higher well water temperature in winter and lower well water temperature in summer improves the operating performance of the system.

3) Due to the north-south orientation of the large glass areas of the building, during the winter the north side requires continuous heating, while the south side requires cooling whenever the sun is shining, which is almost every day in Albuquerque. The heat pump system is arranged



THIRD FLOOR CHASE, contains hot and cold water lines of wrought iron pipe. Photo courtesy A. M. Byers Co.

so that cooling can be done on the south side and heating on the north side simultaneously. Under these conditions the system is essentially a "solar heating system," and heat is actually pumped from the south side to the north side. Very little, if any, makeup well water is required on sunny days, even with outside temperatures in the 30's.

4) Radiant cooling and heating panels of copper tubing — buried in plaster finish in the wall under the window sills and along the outside perimeter of the ceiling — provide a balanced radiation effect to offset the hot glass resulting from direct sun rays. Cooling is required on the south side in November, December, and January — when the sun is low in the south horizon — even with outside temperature as low as 13 F.

5) The radiant cooling panels reduced the air supply by 50 percent of what would have been acquired for an all air system, resulting in considerable saving in building space. Additional advantages include lower fan horsepower and a balanced radiation effect to offset either hot or cold surface effect.

6) The heat pump system requires only two of the three compressors to heat the building, while all three are required for summer cooling. This balance of heating and cooling requirements made the application of a heat pump system economically practical, since air conditioning was a requirement, and also made it possible to have a standby compressor for heating.

7) The heat pump system has proved to be an economical feature both in initial cost and in operating cost. The cost of the year 'round heating and cooling system was roughly $1000 per ton, less than $3 per sq ft of gross floor area. The building has a gross floor area of approximately 120,000 sq ft. The fact that both heating and cooling are provided simultaneously, while the owner pays for only one service, is an operating cost advantage over a conventional system. With a conventional system, it would be necessary to pay for gas for heating and simultaneous electrical energy for cooling due to the south orientation of the building's large glass area.

8) Domestic hot water is provided by a separate heat pump unit, which simultaneously cools circulated chilled drinking water. Well water is used to furnish any additional heat, should chilled drinking water demands not balance with the domestic hot water requirements.

This is one of the first applications of combining a complete heat pump system with radiant panel heating and cooling.

The tower portion of the building has three fan rooms serving four floors each. Each fan system has a north, south, and interior zone. The zoning is arranged so that heating can be delivered to the north zone simultaneously while the interior and south zones are being cooled.

There are completely separate zones for the north, south, and interior of the 12th and 2nd floors because of the additional roof load for the 12th floor and the different construction of the 2nd floor, the entire wall being glass. A zone thermostat in a typical room within the zone controls the air supply temperature.

Solar Compensator Sets Cycle

The radiant panels are controlled by outside temperature on the north side and by outside temperature together with a solar compensator on the south side. The solar compensator which consists of a box with the same ratio of glass to wall area as the building and oriented the same as the south wall, measures the combined effect of outside temperature and the heat gain from the sun. When the combined effect of the sun and outside temperature give an "equivalent exposure temperature" of above 70 F, the radiant panels furnish cooling, with the chilled water temperature gradually reset down to 60 F as the "equivalent exposure temperature" increases to 85 F. When the "equivalent exposure temperature" or on the north side just plain outside temperature drops below 70 F, the water temperature to radiant panels provides heating and the water temperature is gradually reset to 115 F as the "equivalent exposure temperature" drops to 30 F. The theory on this space temperature control system is that the radiant panels offset the outside weather conditions providing either a cool panel surface adjacent to the glass area when the glass is hot due to high

outside temperature and solar heat gain, or a warm panel surface when the glass is cold due to low outside temperature and wind. The air temperature in the zone is controlled independently by a thermostat which controls the air supply temperature from the fan system.

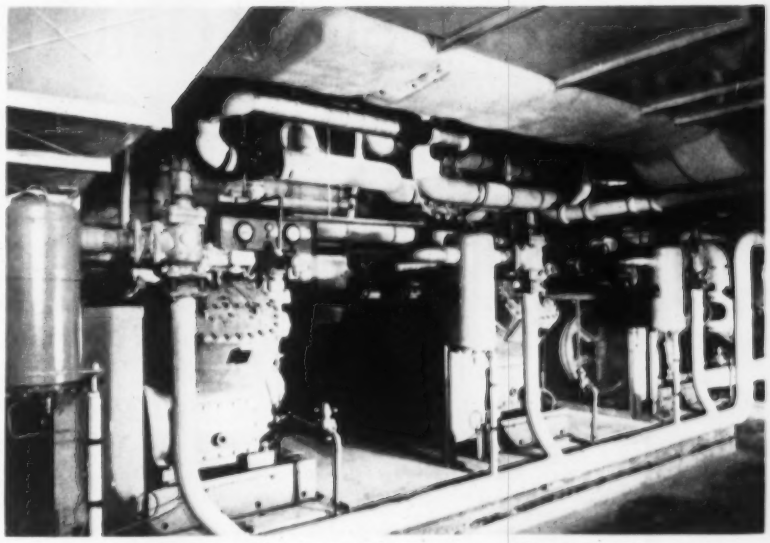
The first floor is heated and cooled entirely by an air system, with zones for each shop area.

Heat and Cool Simultaneously

As previously stated, the system can provide heating and cooling simultaneously. The controls for the main water circulating system are set up for three control cycles as follows, which are activated by outside temperature:

- *Heating*, below 50 F outside, when heating requirements are in excess of cooling.
- *Cooling*, above 65 F, when cooling requirements are in excess of heating.
- *Intermediate*, between 50 and 65 F outside, when either heating or cooling requirements may be greater depending on cloudiness, wind, or building occupancy.

1) When the heating requirements are greater than the cooling, well water is supplied to mix with return water to the water chiller or "evaporator." The amount of well water is controlled by a thermostat in the chilled water leaving the chiller, set at 53 F. The refrigeration capacity is controlled by a thermostat in the hot water return to the condenser. The control point of the hot water is reset by the outside temperature to supply water from 100 F at 50 F outside temperature to 115 F at 20 F outside. For the cycle when heating requirements are greater than the cooling, the chilled water circuit is "open," that is, well water in varying amounts is supplied to the chiller; and after the water is circulated through the building — thereby furnishing cooling to either the south zone radiant panels or air system as required — some of the return water is dumped in the amount equal to the well water makeup. The hot water or condenser water circuit is completely "closed," and water is heated by the condenser and circulated through the radiant panels and fan system coils and returned to the condenser.



THREE COMPRESSORS are required for summer cooling but only two are needed for heating the building. This balance made the application of heat pump system economically practical. Photo courtesy Johnson Service Co.

2) When the cooling requirements are greater than the heating, well water is supplied to the condenser, the amount being determined by a thermostat controlling a modulating valve set to maintain 93 F water leaving the condenser. The refrigeration capacity is controlled by a thermostat in the chilled water return. The control point of the chilled water is reset by outside temperature to supply 55 F water with 65 F outside temperature and 44 F water with 85 F outside temperature. For the cycle when cooling is greater, there is an open circuit for the condenser and a closed circuit for the chiller.

3) For the intermediate cycle for outside temperature, when either the cooling or heating requirements might be greater — depending on cloudiness, wind, or building occupancy — the refrigeration capacity is controlled by either the thermostat in the heating return line or the thermostat in the cooling return line, depending on which is required the most. For example, if the return hot water was 1 F below the control point and the return chilled water was 2 F above the control point, the refrigeration capacity would be controlled by the cooling requirements.

Solar Gain Heats North Side

The system sometimes acts as a "solar heating" system during winter when heat gains from solar radiation on the south side are actually used to supply heat to the north side. As previously stated, the chilled water from the evaporator is pumped through the radiant panels on the south side when the sun is shining to offset the "hot" glass effect. Air cooling is also required even with outside temperatures as low as 20 F due to the large amount of solar radiation, and the chilled water is used to cool the air in the fan system.

The heat picked up by the chilled water on the south side is removed by the refrigerant in the evaporator and transferred to the hot water in the condenser and the hot water is used to heat the north side of the building. Under these conditions, very little, if any, well water is made up into the chiller. There are times when the cooling requirements on the south side exactly balance the heating requirements on the north and there is no well water makeup.

The architects for the building: Max Flatow and Jason Moore. ⊣

Old Patents Show Odd Devices for 19th Century Air Conditioning

Some of the oddest and most interesting inventions in the field of air conditioning were actually patented by the U. S. Government long before "air conditioning" became known. Instructive as well as amusing among such early inventions are the three described here: a "Victorian maiden" room cooler, a 40 F air cooled food chamber, and a refrigerant piped air plenum for cooling and purifying air in buildings.

"To ALL WHOM *it may concern*:

"Be it known that the inventors herein named have invented certain new and useful improvements in methods and equipment for cooling air, which they claim as new and desire to secure by Letters Patent."

So ran many patent applications during the last half of the 19th century covering inventions in the field of air conditioning, then still undefined. For while most of the progress in the science as we know it today was not made until the 20th century, basic developments were underway even 100 years ago that paved the way for later improvements.

Metallic Maiden Gives Room Cold Shoulder in 1888

1 PORTABLE ROOM COOLER was housed in Victorian statue. Ice melting in urn ran down concentric tubes through cold air chamber to drain in figure's arm through vessel into pedestal tank

A PORTABLE ROOM COOLER encased in a metallic statue of a Victorian maiden, decorative as well as mechanical, was patented in 1888 by Ransom F. Humiston, of Boston, Mass.

In his application, Mr. Humiston laid the groundwork for his invention with a careful description of the weather which rings with some surprisingly good 20th century "sell." Said he, "During the summer season the weather often becomes so very hot and sultry that the atmosphere appears to lose all movement and to become perfectly still, and it is almost impossible for a person to keep comfortable or cool, no matter how quiet he remains. This kind of weather is especially felt by those in the large cities, for the buildings are so tall and close together that it is exceedingly difficult to keep up the proper amount of circulation of the air, which becomes hot, impure, and dry, causing the inmates to suffer greatly."

The object of this invention, he explained, was to "provide a cooling apparatus adapted to be located in the upper plane of a room, where the heated and impure air collects, and to allow said air to come in contact with ice and cold metallic surfaces, thus purifying and cooling the heated air and keeping up the circulation in a room by constantly cooling the air as it becomes heated."

His "complete device" is shown in Fig. 1. The urn shaped cooling apparatus is supported by an ornamental statue, the waste from the ice flowing into a tank in

the pedestal. The cooler may also be suspended by chains from the ceiling.

In the upper part of the urn casing, *A*, an ice compartment, *B*, is formed by the horizontal partition, *C*. The partition, *C*, which forms the bottom of the ice chest, also forms the top wall of a cold air and water chamber, *D*, in the lower part of the outer shell. Perforations in Partition *C* open into the upper ends of pipes, *E*, which are secured to the lower side of the partition and extend down into the cold air chamber and have their lower ends sealed.

The cold water tubes, *E*, form circles around a main pipe, *F*. The tubes farthest away from the central pipe forming the outer circle are quite short and do not extend down very far into the cold air chamber. The tubes forming the next circle are slightly longer, and so on, until those tubes nearest the central tube almost, if not quite, extend to the bottom of the cold air chamber. The main tube extends out through the bottom of the outer shell. The cold water tubes are all connected to the main tube by short, transverse, downwardly inclined pipes, *G*, extending from the lower portion of each tube to the longer tube immediately adjoining it. The water of condensation from the outer surfaces of the nest of cold water tubes falls upon the inclined bottom, *H*, of Chamber *D* and passes into the main tube, *F*, through perforations, *f*, in the tube.

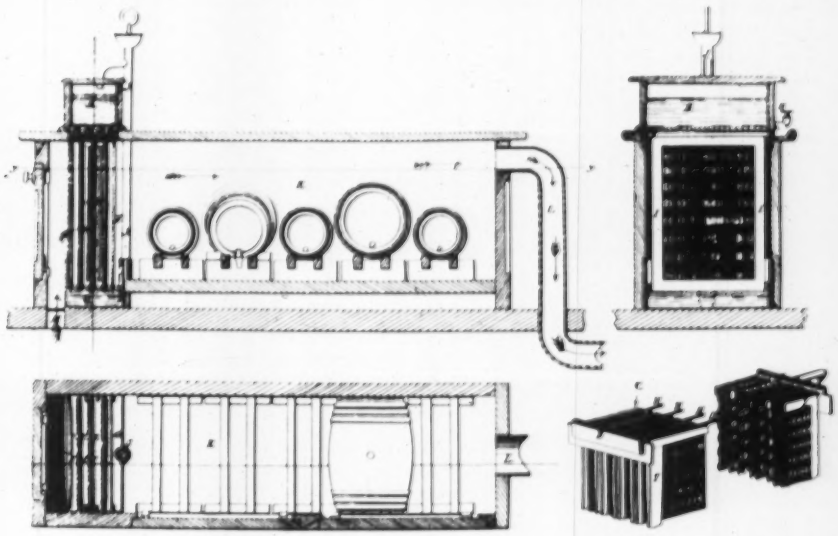
The outer casing or shell of the apparatus is perforated to admit heated and impure air to contact with the ice and the cold air and water tubes.

As the ice melts, it passes into the cold water tubes and flows from one tube to the next, and so on, into the main tube, which conducts the water down through the head and arm of the statue into a vessel, from which it flows into a reservoir in the pedestal.

If the cooling apparatus were suspended from the ceiling or other support, a stop cock on the main tube permitted the waste from the ice to be drawn off when desired.

In staking his patent claim, the inventor made sure that he had plenty of territory for future strikes. "I do not wish to limit myself to any particular form of outer casing, or any particular arrangement of the tubes forming the nest of cold water tubes," he said. "And it is also evident that numerous slight changes might be made in the form and arrangement of the various parts described without departing from the spirit and scope of my invention. Hence I do not wish to limit myself to the precise construction herein set forth, but consider myself entitled to all such slight changes."

Draft Through Water Soaked Cloths Cools Food Chamber



2 MILK, BEER, BUTTER, AND MEAT COOLER consisted of air chamber which was cooled to 40 F by air draft passing through water saturated cloths

AN "IMPROVED AIR COOLING VENTILATOR" consisting of "apparatus by which air is first cooled by contact with conductors constantly saturated with water, and then passed through a close chamber containing anything which it is desirable to cool or preserve" was patented by Friedrich Villard, of Mt. Eaton, Ohio, in 1868. The device resembled a primitive plenum providing air movement, filtration and humidification.

In principle, the chamber was designed to be kept at a temperature of less than 40 F in the hottest weather. Hence, he said, it was "of great value for cooling or preserving milk, beer, liquors, meat, butter, and provisions in general, as well as for cooling wort or mash in breweries."

Drawings which accompanied his application are shown in Fig. 2. From a water tank, *A*, water is allowed to flow

through a faucet, *B*, at any desired speed onto a water grate consisting of a series of shallow troughs, *C*, connected at their ends by transverse troughs, *D*.

Fibrous or perforated conductors, *E*, dipping at their upper ends into the troughs, *C*, extend down to the bottom of the air cooling chamber, *F*, where their lower ends are immersed in the receiving tank, *G*. The paired conductors consist of cloths held with their central parts within the troughs by rods, *H*, and extend down on both sides, where they are attached to frames, *I*, to cause them to stretch across the width of the chamber.

The water is returned from the lower tank to the upper tank by a pump, *J*.

K represents a close chamber or receptacle for food, drink, or any other article to be cooled or preserved.

L, a chimney connected with Chamber *K*, produces a continuous draft or current of air through the chamber.

Air entering at *M* "through wire gauze to exclude insects or foreign matter" is compelled either to pass through the water conductors, *E*, or to circulate around the successive sheets. In either case, the air is brought into contact with a large extent of moistened surface, the rapid evaporation from which is "very effective" in cooling the air, Mr. Villard explained.

Tank *A* may be supplied either by hand or from elevated reservoir or other source.

If desired, the cooling chambers may be arranged in tiers, one above another, so that the water in passing down will flow over the successive conductors.

What he claimed as new is the following:

"1) The water grate, *CD*, constructed substantially as described, for distributing the water over a number of conductors.

"2) In combination with the distributing water grate, constructed and adapted to operate as set forth, the two tanks, *A* and *G*, and a water elevator, *J*, for passing the water repeatedly over the evaporating surfaces, as explained."

Blow Air Over Pipes In Plenum To Cool Building

THE OBJECT of an invention patented in 1880 by Robert Portner, of Alexandria, Va., and B. E. J. Eils, of Washington, D. C., was "to cool and purify air in buildings by blowing it over metallic refrigerating pipes," the inventors stated. The apparatus condensed most of the moisture in the air into water, "thus avoiding the injurious accumulation of snow on the refrigerating pipes, notwithstanding the fact that they are kept, partly at least, at a temperature below freezing."

Their invention had previously been applied in breweries to withdraw the air from above fermenting tubs to carry off carbonic acid and other gases for absorption by the water of condensation forming on the refrigerating pipes.

Another object of the invention was "to provide for continued refrigeration of the air when the artificial refrigerating apparatus was temporarily inactive for repairs or for other purposes."

Still another object was "to provide for drawing air in cold weather from the exterior of the building and forcing it through the air passages of the refrigerating apparatus into the building to displace the foul air therein."

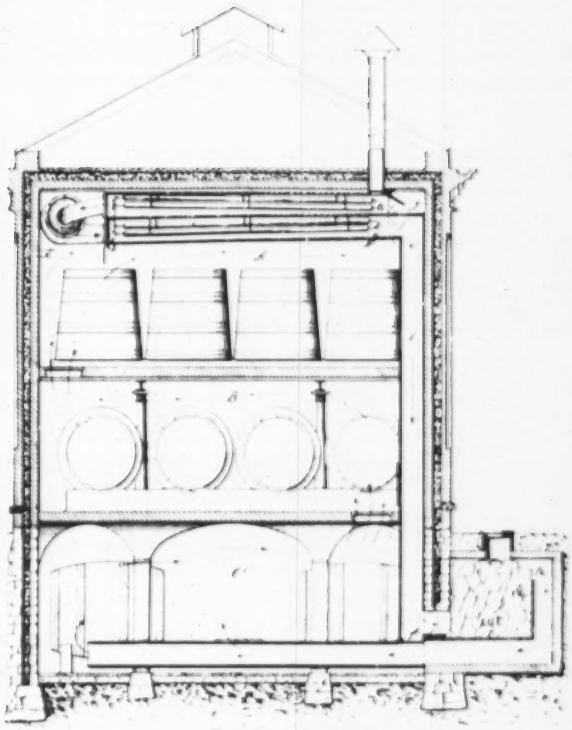
The "devices and combinations" for this "new mode of cooling and purifying air" consisted principally of:

- "A cluster of independent refrigerating pipes or tubes arranged to form an extended line, the refrigerant being supplied to them at one end of the line and exhausted from them at the other end.
- "Tight metallic jackets, preferably corrugated or star shaped in cross section, to obtain a larger surface in a small compass, encircling said refrigerating pipes and filled with a noncongealable liquid.
- "A box for inclosing this extended line of jacketed refrigerating pipes and conveying the air to be cooled, the relative proportions and arrangements of the box and refrigerating pipes being such that the travel of the air along said pipes shall be substantially coextensive with the travel of the refrigerant, but in a reverse direction.
- "A fan or blower for drawing the air from the proper point or points in the building or room to be cooled, passing it through the aforesaid box in the direction stated, and discharging it finally at a point or points remote from where the air is drawn in by said fan.
- "An ice box adapted to receive a few tons of ice and connected with the air flues of the artificial refrigerating apparatus, so that the air therefrom may be passed through said box and cooled by the ice therein, if required.
- "An air trunk connected with the fan or blower and opening into the atmosphere on the exterior of the building, through which air trunk fresh air may be drawn into the building in cold weather."

The brewery application is shown in Fig. 3.

The inventors preferred to use straight pipes. To "obtain and conveniently locate the long line of refrigerating pipes," they used a box, *D*, with two chambers, along one wall and against the ceiling of the 40 ft wide brewery. One length of each pipe was in the upper chamber of the box and the other length in the lower chamber, thus securing an air travel along the pipes of about 75 ft and about a similar travel for the refrigerant.

Anhydrous ammonia, liquefied before entering the pipes by mechanical compression and condensation, is admitted to the refrigerating pipes through branches, *f*, from the induction pipe. After expanding into gas in its travel through the pipes, the ammonia is withdrawn by the exhaust pipe and returned for reliquefaction.



3 REFRIGERATED AIR PLENUM, suspended from brewery ceiling, withdrew fermentation gases to be absorbed by condensation forming on ammonia pipes. Air discharged from plenum was recirculated through air duct, *I*. In summer, air was recirculated through ice filled Chamber *K*. In cold weather, outdoor air was admitted through shaft on roof and blown through plenum and duct to displace "contaminated" air, which was "let out through doors and windows"

A fan blower, *H*, draws the air into the upper chamber of box at the exhaust end of the pipes and blows it through the lower chamber and out at the induction end of the pipes. At that point the cooled and purified air enters a trunk, *I*, which passes down into the lower room, *C*, to discharge the air. Openings in the floors provide a circulation of the air from the lower room through the room above it and back again into the fermenting room.

Moderately strong currents of air passing through the box along the refrigerating pipes were "cooled constantly to from 8 to 10 F." Most of the moisture in the air was "condensed off in the form of water by the refrigerating pipes, which therefore remained comparatively clear of frost. What little moisture did freeze on them assumed the condition of ice rather than snow, and did not materially interfere with the refrigerating action of the pipes on the air."

While these effects might be produced by immediate contact of the air with necessarily rather small ammonia pipes, provided the ammonia and air are made to travel a sufficient length, the inventors found it impractical to attain such results by immediate contact in the travel. "Hence, we jacketed the ammonia pipes by closed sheet iron jackets filled with a suitable noncongealable liquid, and in order to obtain greater surface made these jackets corrugated or star shaped."

The refrigerating pipes declined in the direction of the travel of the refrigerant, so that the water of condensation could run along them toward the less cold portions of the pipes until it dropped off. The bottom and partition of the box, also declined slightly to drain the condensate to one end for trapping. The box was made of wood, with a series of large doors to provide for ready access to the pipes. Windows at various points permitted observation of the condition of the pipes. The pipes were supported by hangers.

In order that the refrigeration of the air might continue without interruption at times when the artificial refrigerating apparatus required repairing, or was temporarily diverted for other use, a chamber, *K*, could be provided at any point reasonably convenient for connection with the air trunk, *I*, and adapted to receive a few tons of ice at a time. "Gates *I'* and *I''* control the course of the air currents, so that they may shun the chamber or be compelled to pass through it."

This ice chamber could also be used as an auxiliary of the artificial refrigerating apparatus in summer by passing the air from the apparatus also through this chamber filled with ice. If the air came down from the box at or below the freezing point, it would not, of course, melt the ice.

The air shaft, *L*, opened into the atmosphere, and was connected with the fan through the box so that in cold weather outdoor air could be drawn into the building and blown into the shaft to displace the "contaminated" air in it, which was "let out through the doors and windows." In warmer weather this air shaft had to be tightly closed and made "nonconducting" where it joins the box.

1 DRAMA STRUCTURE has 501 seat auditorium and several smaller classrooms and shops. Lobby is served by six radiant floor panels and two unit ventilators

Three Systems Heat College Hall

Utilizing steam from the central boiler plant, forced warm air, radiant floor panel, and unit ventilator systems heat and ventilate this auditorium-activities building.

By Lester S. Ries

Formerly Superintendent Buildings and Grounds Oberlin College

THREE DIFFERENT SYSTEMS — forced air, hot water floor panels, and convectors and unit heaters — supply heat from a central steam heating plant to the new $1¼ million Hall Memorial auditorium at Oberlin college, Oberlin, Ohio. These various heating methods were prompted by the different uses for the building.

Totalling 637,845 cu ft — 20,116 sq ft — the structure accommodates a variety of activities, including concerts, lectures, movies, drama, and other types of stage use. The main auditorium, seating 501, also serves large classes. In addition, a two-story wing has classrooms, offices, and practice spaces.

Forced warm air is the system which heats the auditorium, with 6½ air changes per hr. The hot water radiant floor panel system is installed in the lobby, which also is served by separate unit ventilators to pro-

vide air circulation. Floor standing unit ventilators and unit heaters serve the two drama workshops. Unit ventilators and finned tube direct radiation serve the classrooms. All other areas have finned tube direct radiation with individual exhaust provided.

The heating and ventilation system is diverse and flexible enough to permit partial or complete use of all facilities.

The winter design outdoor temperature is −10 F; the indoor temperature, 70 F.

Future summer cooling, with the addition of refrigeration, is provided for in the fan sizing and duct lining and insulation.

Radiant Panels Use Oil

The radiant floor panel heating installation consists of a network of six panels of 1 in. extra heavy mild steel pipe laid 8 in. on centers. The circulating fluid is light heat transfer oil. The centrifugal pump handles 50 gpm against a 50 ft head. The oil is circulated through a converter capable of heating 50 gpm from 130 to 150 F, with steam at 5 psig. The system is equipped with an open vented 40 gal expansion tank. Each of the six panels is provided with a lockshield valve in the return riser.

The floor panel system is controlled by means of a thermostat in the inlet liquid. The temperature control is manually adjusted to a desired value of 140 F by throttling the steam control valve to the converter. A high limit thermostat installed in the exit liquid line from the heat exchanger is set to override the inlet thermostat whenever the exit limit temperature exceeds 160 F. When this happens, manual resetting is necessary. These controls are modulating. The system is dependent on manually starting and stopping the pump.—

In a fan room at each end of the lobby is a 10,000 cfm unit ventilator, with an output of 73,000 Btu per hr. The units discharge through supply outlets flanking the main entrance doors.

In the 165,000 cu ft main auditorium the sloping slab floor is laid on solid ground. Heating is accomplished entirely by warm air furnished by an 18,000 cfm supply fan. A 13,400 cfm fan exhausts the air.

In the machine room above the stage there are two complete ventilation systems — one for the supply and exhaust of the main auditorium, and the other for the supply and exhaust of the stage proper and trap room.

Outdoor air is admitted into the building at the ground level to insure cooler air for summer ventilation. This is particularly important prior to the installation of the air conditioning equipment to achieve as much cooling effect as possible. The supply fan has an outlet velocity of 1300 fpm and is designed to operate against a static pressure of 1¾ in. WG. It is sized to furnish 30 cfm per person, with 20 air changes per hr for the lower strata to provide proper distribution when air conditioning is installed.

Offset Ducts Supply Auditorium

Outdoor air supplied through a 108 × 24 in. vertical duct, with a 9½ × 3 ft aluminum louver at the ground level, is introduced into the auditorium in four banks of ducts in ceiling offsets. These offsets reduce reverberation and are part of the acoustical design. Thirty-eight outlets, 30 × 4 in., diffuse 450 or 550 cfm each, toward the stage.

The ceiling height of the auditorium varies in stepback panels from 20 ft at the rear to a maximum of 30 ft at a spotlight gallery near the stage.

The return and exhaust fan withdraws air at the floor level through side wall ducts, each with 11 intakes of various sizes from 30 × 6 in. to 54 × 12 in.

The system operates quietly and without drafts.

Exhaust Stage Air at Rear Wall

The stage is 80×43×50 ft high. The trap room is 70×30×9 ft high. The supply fan for this section, drawing outdoor air through a 108×24 in. vertical duct from ground level, has a capacity of 13,000 cfm with an outlet velocity of 1430 fpm, against a system resistance of 1¾ in. WG. This system furnishes tempered air to both the stage and trap room.

2 56 CEILING DIFFUSERS direct supply air toward auditorium stage from four stepdown ducts. Air is exhausted through 11 floor level grilles along either side wall

The stage supply inlets on the side walls are 22 ft above the stage floor and discharge 1350 cfm through each of four 36×18 in. diffusers on each side wall. The trap room ceiling has five 24×6 in. supply diffusers which furnish 500 cfm each.

The return and exhaust fan for the stage has a capacity of 9200 cfm, operating with a system resistance of ¾ in. WG. The exhaust grilles are 19 ft above the stage floor at the rear wall. There are eight outlets exhausting 1150 cfm each through 36×18 in. grilles.

The trap room has a separate ceiling mounted exhaust fan handling 1050 cfm. This fan discharges directly to the atmosphere..

Supply, Return Fans Interlocked

The temperature controls of the ventilation system for the auditorium, stage, and trap room operate as follows. Starting the air supply energizes an electro-pneumatic switch which positions the several motor dampers, causing the minimum space (50 percent) air damper to open wide. The maximum outside air damper and the return air and exhaust damper both take their position as determined by the return air thermostat or manual positioning switch. The supply fan and its return fan are electrically interlocked so that the return fan starts and stops as the supply fan is started and stopped.

A duct thermostat in the outdoor air intake opens the steam valve to the heating coils whenever the outside temperature drops to 40 F or below. The duct thermostat placed in the return air flow closes the maximum outside air damper, opens the return air damper, and sets the exhaust air damper to its minimum position as the return air temperature drops below the thermostat setting. As the temperature drops further, this thermostat closes the bypass damper at the heating coil. Duct thermostats in the fan discharge, consisting of one for each coil bank, limit the action of the return air thermostat so that the discharge temperature will not drop below 60 F.

The manual positioning switch overrides the action of the return air thermostat on the several automatic dampers at the option of the operator. The trap room exhaust fan is also electrically interlocked with the stage and trap room supply fan.

Use Floor Type Unit Ventilators

Unit ventilators serving the shops and classrooms allow 100 percent recirculation of air or 100 percent circulation of outdoor air.

Shop No. 1 is heated by means of two floor type unit ventilators of 450 EDR each, furnishing 1250 cfm. An exhaust fan of 2125 cfm discharges directly to the atmosphere with four exhaust grilles, 24×10 in., installed 18 ft above the shop floor.

Shop No. 2 has one floor type unit ventilator of 342 EDR, furnishing 1250 cfm.

Two unit ventilators serving each classroom have heating surfaces of 280 EDR, with an air supply of 750 cfm each.

Shop No. 2 and the two classrooms are ventilated by means of a 3100 cfm exhaust fan discharging to the roof. Each classroom has three 24×6 in. exhaust grilles, each of which may exhaust 350 cfm. These are around the rear wall of each room near the ceiling.

The public toilets, projection room, and the mechanical room have separate small exhaust fans. These rooms, offices, corridors, and storage rooms are heated by finned tube radiators.

Measure Condensate

All heating elements throughout the building are connected to a duplex vacuum pump in the basement which returns the condensate via a 2½ in. line to the central station heating plant against a 20 psig discharge head. The pump, with a capacity of 6.8 gpm, operates with a vacuum of 5½ in. Hg. The building condensate, before being handled by the pump, passes through a condensate meter, which measures the volume of steam used to heat the building.

Heating statistics for the first two years of operation—see Fig. 3—show that operating efficiency increased the second year.

The building is furnished with 35 psig steam generated in the college central heating plant. A detailed description of the plant was published in the July 1950 HPAC. Steam supplied through an 8 in. main which is reduced to 6 in. as it approaches the auditorium.

Architects for the building were Harrison & Abramovitz, with Eldredge Snyder as Associate. Mechanical engineers were Jaros, Baum and Bolles. ≠

3 HEATING STATISTICS recorded for first two seasons of operation show increased efficiency in second year for Hall auditorium's three-way heating system

	1953-1954						1954-1955					
Month	Degree Days	Steam Consumption, lb	Steam, lb per deg day	Steam, lb per 1000 cu ft of building volume	Steam, lb per deg day per 1000 cu ft of building volume	Steam, lb per sq ft EDR	Month	Degree Days	Steam Consumption, lb	Steam, lb per deg day	Steam, lb per 1000 cu ft of building volume	Steam, lb per deg day per 1000 cu ft of building volume	Steam, lb per sq ft EDR
Sept.	53.9	17,700	329	28	0.52	1.0	Sept.	53.1	30,100	565	47	0.89	1.7
Oct.	340.5	112,100	328	177	0.52	6.3	Oct.	401.2	103,400	257	162	0.40	5.8
Nov.	681.6	206,400	303	324	0.48	11.5	Nov.	751.8	261,600	347	409	0.54	14.6
Dec.	1003.7	360,500	360	566	0.56	20.1	Dec.	1073.4	355,500	330	557	0.52	19.9
Jan.	1165.7	444,400	381	697	0.60	24.8	Jan.	1212.0	378,900	315	592	0.49	21.1
Feb.	849.4	329,000	387	515	0.61	18.3	Feb.	961.9	374,500	389	587	0.61	20.9
March	991.0	355,500	336	523	0.53	18.7	March	854.2	333,500	401	522	0.63	18.6
April	373.7	130,000	348	203	0.54	7.3	April	270.7	76,500	283	120	0.44	4.3
May	330.0	67,100	203	106	0.32	3.7	May	132.0	36,000	273	57	0.43	2.0
June	48.3	20,400	421	32	0.66	1.1	June	31.5	13,500	432	21	0.68	0.8
Total	5857.0	2,205,100	378	3454	0.59	123.1	Total	5722.0	1,963,500	343	3077	0.54	109.6
Hall Auditorium				3454	0.59	123	Hall Auditorium				3077	0.54	110
All College Buildings				4259	0.73	338	All College Buildings				4512	0.79	351

Question of the Month

WHICH SHOULD YOU USE—

Steam or Electrical Tracing For Pipe Lines?

By Lee P. Hynes
Consulting Engineer

This question, asked by R.H.C., was published previously and is repeated here in nine parts with answers by a member of HPAC's board of consulting and contributing editors. Says Mr. Hynes: "It is always nice to get definite simple answers, but that is seldom possible in modern engineering where actual operating conditions and local requirements vary as much as they do in a pipe line project. Careful engineering is necessary for such projects." Other comments for publication will also be welcome.

1. What type of steam tracing arrangement has been most successful for pipe lines?

There are four ways that are actually used to steam trace a pipe line:

a) A parallel steam pipe is run under the pipe line, and both are enclosed by a common covering of heat insulation. This is the most widely used method.

b) A steam tracer pipe is run through the interior of the pipe line. This is thermally more efficient, but there are added problems of maintenance, such as removal of condensate, and provision for expansion of the steam pipe. Jumper loops must be provided around any valves in the pipe line. Leakage of steam can ruin some materials and for others the temperature of a steam pipe is too high for direct contact with the heat sensitive fluid.

c) Pipe lines are sometimes heated by steam jackets. As the jacketed pipe must be installed in sections, except for some welded lines, any joints or flanges require steam jumper loops around these. This is also true at valves, and these loops add to the problem of draining off condensate.

d) External heat for a pipe line is sometimes applied by wrapping spiral steam tubing around it. See answer to Question 2.

2. What are the advantages and disadvantages of spiral wrapped tubing vs. parallel tubing?

Spiral wrapped steam tracer tubing has the two disadvantages of being hard to drain of condensate and requiring the removal of the insulation covering if any repairs are needed. The latter is to a considerable extent common to all steam heating systems.

3. What is the most economical and satisfactory insulation method for steam traced lines from 1 to 6 in. in diameter?

I do not think the discussion of tracer heating should be confined to pipes not over 6 in. in diameter. Many heated lines are much larger than this. However, in most cases — regardless of size — prefabricated sections of heat insulation covering are used. Additional weatherproof sealing is added as required. There are many types and grades of such insulation.

4. What are average installed costs of steam tracing and insulation on existing pipe lines?

If there is any such thing as an average cost, the best source of information is from firms who special-

ize in applying this type of insulation to pipe lines.

Obviously, costs will vary greatly, depending on whether the pipe line is overground or buried. In the latter case, the ground conditions are important factors. The number of turns, valves, fittings, or branch pipes are also features to be considered.

5. What size of tracing and what materials are recommended for tracing lines?

This should also be answered, if possible, by the type of firms mentioned in the answer to Question 4.

6. What advantages and disadvantages have the various types of electrical tracing for outdoor pipe lines?

There are three general types of electrical heat tracing for pipe lines:

a) *Resistance heating of the pipe wall.* In this method low voltage and high amperage current is passed directly through the pipe itself. The resistance of the pipe to the current flow produces heat in the pipe wall.

For small pipes of material having suitable resistance characteristics, and operating at moderate temperatures, this method is often desirable. It has advantages too where there are many bends in a small pipe line, which would make it hard to follow by more conventional tracing systems.

The pipe must be divided into sections, each of which is electrically insulated and of a definitely known length. The resistance in ohms for each individual section must be accurately determined at the operating temperature.

From this data and known factors for heating different materials, an experienced engineer can compute the required voltage and amperage which must be applied to each insulated section of the pipe. For safety reasons the maximum allowable voltage is 30 volts for this type of service.

The pipe sections must be comparatively short, and suitable special transformers must be installed along the pipe to feed each section with its proper electric current. Valves, fittings, and branch pipes must be carefully considered and provided for in the circuit design.

Larger pipes have such low ohmic resistance that they are not well suited for heating by this resistance method.

This method of pipe heating is not considered safe for use where any fire hazard may exist, as a chance spark could ignite inflammable liquids or vapors.

It is very difficult to apply this system to underground lines unless they are located in a tunnel large enough for access by service men.

b) *Wrapping pipe with electric heating cable or tape.* This method applies heat to the outside of the pipe line under the insulation covering, but electric elements of this kind are comparatively frail and subject to damage under hard field service conditions. To repair or replace them necessitates the removal of the insulation covering. Elements of this type must be single phase and are not well suited for the higher commercial voltages such as 440 or 550 volts, which are the most economical to use for any but small jobs.

This type of heating is not suited for underground pipe lines unless they are in a tunnel large enough for access by service men. They are also difficult to install for safe use in any hazardous atmosphere, or to keep watertight at the high voltage terminals.

c) *A third method* for electric pipe tracing has received attention in recent years because it has been designed to overcome the weak points in the older system and to meet all conditions, and has proved successful in use.

All live electrical parts are enclosed in straight or curved sections of 2 in. standard steel pipe, which can be assembled in lengths up to 100 ft or more. These pipes are installed the same as a steam pipe, either inside the pipe line or underneath it, and enclosed with a common insulation covering.

The similarity to steam tracing ceases here. One end of each electric heater pipe is closed and seal welded. The other end has a rugged terminal fitting with a threaded connection for the electric conduit for power supply. It also has a port closed by a brass pipe plug through which the complete electric heating element is introduced into the pipe enclosure or can be withdrawn from it.

Where the heating pipe is inside the pipe line, the terminal pipe end is curved out through the pipe wall and seal welded to it. The closed inner end of the pipe is free so the pipe can expand or contract at will.

The terminal fitting is outside the insulation covering and the electric element is always readily accessible without in any way disturbing the pipe or the insulation covering. Where the heating pipe is located under the bottom of the pipe line, the terminal end simply comes out through the insulation covering.

For underground lines the same practice is followed except the terminal end of the pipe is longer to bring the terminal fitting either above ground or to a shallow flush box, if traffic precludes connections above ground.

Under any of these conditions the terminal fitting is always readily accessible, and long, rugged, flexible electric heating elements each for three phase high voltage circuits such as 440 or 550 volts can be inserted in lengths of 100 ft or more or withdrawn at any time by removing the brass pipe plug in the end of the terminal fitting.

For power supply a three phase overhead line can be used, or if preferred a conduit line can be laid along the course of the pipe line. Balanced three phase connections are taken off at points where terminals are located. The terminal ends of two pipes can be located together, which doubles the distance between feed-in points from the power supply.

A system of this kind can be designed and installed in a manner that makes it as permanent as the pipe line itself. Temperature control is simple and automatic, maintenance is low, and inspection, test, or even

READER ASKS —

"How Can I Organize an Engineering Office?"

"I would like to know how to proceed to organize my own consulting engineering office.

"I have been a manufacturer's representative for many years and now would like to go into the consulting engineering business. I would like to know where I can find the necessary information that will instruct me legally as well as in the other phases toward the proper procedures in setting up the right kind of organization. Also, I am interested in obtaining information on planning and accounting procedures for this type of operation.

"Any information that is available in published form or as advice from HPAC readers will be greatly appreciated."—L.W.W.

• *YOU ARE INVITED to contribute a question for publication, or an answer to a published question. Please address your reply to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

repair can be done easily without any disturbance to the operation of the pipe line service.

7. How often must steam traps be placed on steam tracing lines; i.e., how many feet of tracing should be used before trapping out—for spiral or parallel tracing and for the various sizes and materials?

The location of steam traps for bleeding condensate from steam tracers must depend on the pipe line layout and changes in elevation level, as low points must be drained. This can only be determined for each specific job.

8. What are the average installed costs of electrical tracing and insulation on existing pipe lines 1 to 6 in. in diameter?

It is impossible to give any average costs for electric pipe tracing, the same as it is for steam tracing. It all depends on the layout of the job and local conditions.

9. Which system, steam or electrical, seems to be the best on a first cost basis, and on an overall basis?

This question is also hard to answer for reasons given above. In general, a well designed electric system should cost about the same as a steam system for overground location.

For underground location the steam system should cost more because it requires service pits and manholes for trap locations, and these cost real money.

The comparative availability of convenient electric or steam supply is also a factor. It is easier to run a power line than to install a long steam supply pipe. Ground conditions also are more important for the installation of a steam pipe.

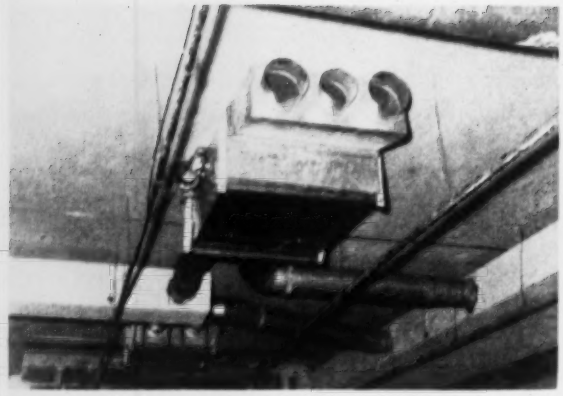
The above comments refer to the first cost of the systems. As to overall operating costs including maintenance, depreciation, and labor of supervision, the evidence is much in favor of the electric system. ◀

Clock Turns Louvers with Sun's Changing Position

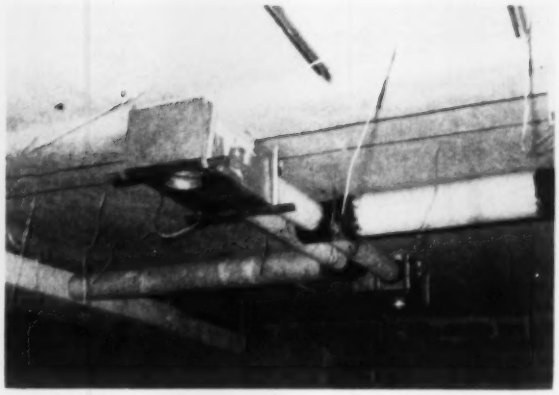
. . . to reduce air conditioning load

VERTICAL LOUVERS, 19 ft long, turn with the sun to keep its rays from heating the interior of the new building of the American Association for the Advancement of Science, Washington, D. C. They are regulated by a time clock mechanism. The aluminum louvers were installed to decrease the building's air conditioning load

How We Started Doing High



1 HIGH PRESSURE VALVE UNITS with low pressure outlets distribute hot and cold air from branches of two main risers. Units must be carefully baffled to prevent stratification



2 SINGLE OUTLET UNITS receive hot and cold air from multiple valve unit, have volume dampers permitting heating or cooling. Note that 45 deg takeoffs were avoided

By G. C. Savage

Bevington, Taggart & Fowler
Consulting Engineers

UNTIL four or five years ago, we looked upon high pressure with considerable suspicion. We actually had to be forced into doing our first high pressure job, for air conditioning the Lincoln hotel in Indianapolis. It looked like a reasonably "easy" job: one of those where you could go in, set fan-coil units in each room, pipe them up to the water chilling equipment and call it a day. But it wasn't that easy.

I suppose we should have been forewarned when our "walk around," showed that all the radiators in the building were on inside walls. "Fine," we thought, "we can set units under the windows and not disturb the radiators at all."

A set of plans showed why the radiators weren't under the windows. The beams at the outside walls were so wide that you couldn't pipe up beside them without coming up way out in the room and so deep that you couldn't drill through them without going through the ceiling of the room below.

The interior framing members were just about as deep as those at the outside walls. They filled the space between floor and ceiling below so completely that no horizontal piping could be run without exposing it in the room below. Vertical piping from the top or bottom proved to be just as difficult. The street floor was occupied by the hotel lobby and a number of stores or shops. In dropping risers to mains in the basement we would have had to make numerous offsets in the shops and lobby. Piping down from the top also proved to be impractical. The top floor was made up, almost entirely, of ballroom and dining rooms.

Next we considered running supply ductwork down the corridor ceiling and returning the air through the corridor to a unit or two at the end of the corridor. This proved to be impractical for two reasons. The supply ductwork had to be so large that it made the corridor ceiling objectionably low and the only space available for equipment would be one of the smaller guest rooms. Naturally, the management didn't think much of giving up one room on each floor.

We made a thorough investigation of high pressure or high velocity systems because there seemed to be no other solution. After seeing a couple of these systems, we were impressed by their simplicity. Next we looked over the various high pressure outlet boxes being offered, picked the one with the best design principles.

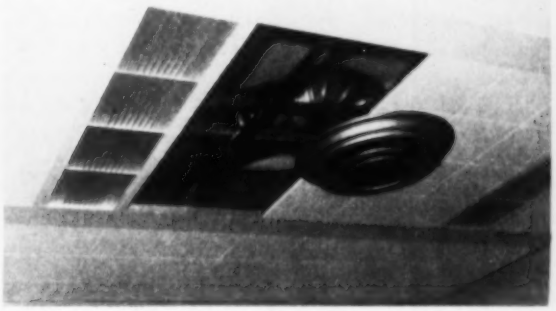
We installed the fan and coils on the roof, from which two relatively small ducts descend vertically down the outside of the building to bypass the top floor dining rooms. At the next to the top floor these ducts enter the building and descend vertically down inside the ends of the corridors. Small supply mains were furred into the corridor ceilings and branches or runouts taken off to high pressure outlets just inside of each room.

The system performed beyond our wildest hopes. There was absolutely no noise within the guest rooms. You had to hold your hand in the air stream to tell whether or not the system was running. The outlets did not hiss or whistle when turned completely off by the manually operated controller. There were a few spots in the corridor where air movement could be heard, but only faintly. This was most noticeable at the ends of

Velocity Air Conditioning

. . . for hotels, banks, offices, and factories, with a review of the results obtained and some of the things we learned

3 FLEXIBLE PLASTIC DUCT to diffuser and flexible conduit to lighting fixtures permit easy moving of partitions to suit future tenants. Individual room control is provided



4 SHEET METAL ELL is used where space limits turning radius. Diffuser, fully adjustable and with smudge ring, is selected in same manner as for low pressure

the corridor where the branch duct took off from the main riser but even there the noise was not objectionable.

Again It Was Last Resort

We were more or less forced into our second high pressure job. The Indiana Bell Telephone building at Shelbyville, Ind., had been designed to use a small central fan system to supply dehumidified air for humidity control and ventilation, and fan-coil type room units for dry bulb control. For some reason, the plans for this building were shelved for a couple of years. In the meantime, the telephone company decided that they wanted a different system.

The architectural plans were revised and instructions issued to alter our original design. We found that the small air shaft intended for the original system had not been enlarged. The architect pointed out that to enlarge this shaft to the point where conventional ducts could be used would require the complete redesign of the building. In meetings with the architect and owner, we pointed out that we could get a high pressure system into the building without change. Somewhat reluctantly the owner agreed, but only after it was emphasized that the new system would require no ducts — over telephone equipment — larger than 10 in. and that they could use efficient filters installed at a single location for easy maintenance.

Each zone is fed from mixing dampers on a hot and a cold deck. The coils and filters also are conventional. The fan discharges into a muffle chamber. The return air ducts are conventional.

During final inspection, one of the delegation turned to our representative and said, "It sure looks pretty. Now turn the fan on and let's see if it works." The fan had been running the entire time that the inspection was being made! The building was completely empty. There was neither telephone equipment nor furnishings to absorb any sound.

Third Job Was a Natural

We didn't have to be forced into our next high pressure job. This one seemed to point in that direction right from the start.

National Homes, at Lafayette, Ind., remodelled one of their factory buildings to provide new office quarters. Much of this building was a single story with a saw tooth roof. The ceiling for the new office was installed a little below the low point of the saw teeth to provide space for lights, piping, and ducts. All insulation was placed immediately on top of the ceiling.

Here, the small high pressure ducts were a double blessing. They were small enough to worm through the construction without difficulty, and the cost of insulating them — against the extremes of summer and winter temperatures in this attic space — was less than the cost would have for larger ducts. Here we reduced the size of the return ducts also. We took standard ceiling diffusers for return air inlets, built a sound trap behind them, and boosted the return air velocity far above our usual practice.

Fourth Job Is Pride and Joy

Our fourth high pressure job is our pride and joy. This job is unusual, to us, in more than one way. It is one of the few jobs we have ever done where cost was secondary. This

was to be a show job and we were to provide the finest system we could produce. Both the architect and the owner had pretty definite ideas about the results they wanted.

Some four or five years ago we did our first job for the same owner, an addition to the main office of the Indiana National bank. This first system used a central fan to provide very dry air to the entire building for humidity control and ventilation. Individual control was effected by fan-coil type room units under each window for the private offices and with a combination of room units and central type units for the larger spaces. At the time this system was laid out, we felt that it represented just about the best that could be done.

Throughout much of the year, its operation leaves little to be desired. Summer humidity as low as 40 percent can be maintained without difficulty, and each office has a fair degree of individual control. Many days require a little heat to take off the morning chill and, by midafternoon, need full cooling operation. The original system was not sufficiently flexible to accommodate these changes. It is all automatic, of course, but there is a lot of water in the system. Once this water was heated up so the fan-coil units could function as heating units, it took hours to cool it down to the point where they could serve as cooling units. Usually, some of the areas are still demanding heat when others should be well along on their cooling cycle. Attempts to provide off season warming by means of the primary air were no more successful; the areas that needed the least heat got most.

When the bank decided to build the Indiana building, they knew what they wanted, or at least what they wanted to avoid. Through their architect they required the following:

1) It must be possible to cool one room while heating another. No system requiring major changeover was to be used.

2) Each room or space was to have individual temperature control.

3) The system had to be physically flexible. Partitions would be changed to suit the various tenants.

4) All routine maintenance had to be limited to equipment areas.

5) There were to be no chilled water lines, air vents, or drains to be installed within any of the occupied areas.

This building is served by two high pressure dual duct systems. One system, in the basement, serves the first and second floors. The other system, in the penthouse, serves the third to twelfth floors. Two main risers, one hot and one cold, run down the building utility core and feed hot and cold branches on each floor. Distribution is through high pressure valve units, each having two to four low pressure outlets connected through flexible plastic ducts. Outlets are standard ceiling diffusers, each having volume dampers, adjustable air deflection plaques and anti-smudge cones. Dehumidification is accomplished by the use of a lithium chloride absorbent system and after-cooling by means of chilled water coils. Filtering is done with paper media electrostatic filters.

Other Jobs Utilize Heat Pumps

Some of our high pressure jobs are interesting, more because of the systems to which they are connected than the fact that they are high pressure. One of these, a dual duct high pressure system now being completed in the Merchants National bank in Muncie, Ind., is served by an air source heat pump. Another system, now being installed in the Seymour exchange of the Indiana Telephone Corp. is also connected to an air source heat pump, but this job has supplementary boiler heat. In this case, the heating capacity of the compressor is used to meet the demand for some heating during the intermediate seasons. The compressor was sized on the air conditioning load and cannot carry the building during really cold weather. It can however, avoid starting the boiler until the heating season is well under way.

• Here's What We Learned

Naturally we have learned as we have gone along. On the Lincoln hotel we learned that there is no substitute for welded ductwork. On others we found that some acoustic treatment is usually necessary in the returns if they are short and close to the fan. While the supply system may be almost dead silent, fan noise can come back through the returns.

Also we learned that dampers have to be "beefed up" to stand higher pressures.

We have worked out a more or less standard pattern of calculation and selection. Our heat loss and heat gain calculations are the same as those for a more conventional system. The only difference is that the heat generated by the fan cannot be neglected as it often is on low pressure work.

Diffusers and outlets are selected in the same manner as for low pressure. After all, it is low pressure air when it gets to the grille or diffuser. We do insist that grilled outlets and ceiling diffusers be fully adjustable, and on ceiling diffusers we insist upon the use of a smudge cone or ring.

We are particularly fussy about our selection of the high pressure diffuser or valve box unit. The damper or dampers must have essentially straight line characteristics and must shut off without hissing or whistling. This is especially true of dual duct units. Each unit must have well designed acoustic treatment and be reliably rated as to noise so that intelligent selection can be made. Dual duct units, particularly those with multiple outlets, must be carefully baffled to prevent stratification.

We usually size our ductwork for a maximum velocity of 4000 fpm and a maximum pressure drop of 1 in. per 100 ft. In other words, above about 3000 cfm, velocity is the limit-

ing factor, below about 8000 cfm. pressure drop is the limiting factor. If you will take the "Friction of Air in Straight Ducts" chart in the American Society of Heating and Air-Conditioning Guide and draw a red line from the top of the chart down the 4000 fpm line to the point where 4000 fpm intersects the 1 in. WG line, then continue straight down the 1 in. WG line to the bottom of the chart, you will have a very useful tool for sizing high pressure ducts at a glance. You will find that as the diameter of the ducts is reduced, the velocity is reduced; so the velocity will stay within the limits recommended by most manufacturers as being correct for admission to their high pressure units.

Coil surface is sized in the conventional manner since the high pressure becomes high velocity only after it has entered the ductwork. On hot and cold deck, and on dual duct systems; we usually size our cooling coils for 400 to 450 fpm face velocity and our heating coils for 800 to 900 fpm face velocity. The difference in velocity tends to offset some of the difference in pressure drop due to difference in coil depth.

The supply fans usually turn out to be Class 2. We size our fans for the most efficient operation against the calculated pressure and ignore outlet velocity and tip speeds. In other words, we select the fan that will deliver the required amount of air against the calculated resistance with the least power required. So far, all of our fans have had backwardly inclined blades.

Filters are selected in the conventional manner. Most of the filters used on these jobs have been paper media or paper media electrostatic. There is only one rule we follow. Use the best the job will stand.

Wherever practical, we will use return air fans. By maintaining more nearly equal pressure drops across the outdoor air and return air dampers, the desired percentage of outdoor air can be more nearly achieved. With high pressure differences due to long returns, you may find you are introducing 30 or 40 percent outdoor air instead of the 15 or 20 percent intended.

On dual duct systems of any size, we usually use dampers at the hot and cold duct connection to the coil plenum. These dampers are controlled by pressure regulators installed at a distance from the fan on each duct. Their purpose is to limit the pressure in one duct when most of the air flow is through the other. Make sure that these dampers are amply strong. We have blown ordinary dampers on into the ductwork. The same holds true, of course, of hot and cold mixing dampers on single duct systems.

• We Suggest 10 Do's and Don't's

• Don't use rectangular ductwork if it can be avoided. Round ducts are usually a lot less costly, and will be quieter. Under a little pressure the rectangular ducts try to become round, so they require a lot of bracing to prevent oil canning and deformation. We tested some rectangular ducts under 3 in. WG static pressure and found that they had to be stay-braced like a boiler to keep their shape.

• Do consider the use of the commercially available spiral duct. This seems to work out very well. We insist that this ductwork be welded at transverse joints, in spite of many protests from sheet metal contractors. It can be done and done very well with the proper equipment.

• Don't use 45 deg branch takeoffs or splits. These at certain velocities act like an organ pipe.

• Do make the takeoff at 90 deg and, if you want to reduce the pressure loss, use a cone shaped exit from the main duct.

• Don't feel that a flexible connection between the ductwork and a high pressure outlet is essential. These flexible ducts are advantageous in aligning equipment but they contribute nothing to its operation.

• Don't use any volume dampers, balancing dampers, splitters, or the like, in any supply ductwork after it leaves the fan system. If the damper or dampers in the high pressure units are properly designed, you can do all of the balancing at the unit. Dampers in the ducts will cause noise and erratic operation.

• Don't use any dampers in the high pressure side of the fan system unless they are designed for high pressure duty. Remember that the pressure against these dampers can run as high as 30 to 40 lb per sq ft.

• Don't rely on masonry walls to form part of a plenum unless they are properly reinforced, plastered and sealed. High pressure air will go through a concrete block or masonry wall as though it were a sieve. The pressure is frequently high enough to crack lightly built walls.

• Do be specific about high pressure plenum construction. Unless a sheet metal man has had experience with one of these jobs, your plenum is apt to have a thousand leaks.

• Finally, do treat the fan discharge with a good acoustic material. Many of the high pressure handbooks have instructions for building such sound traps, usually in enlarged sections of the ductwork. We have found that these, because of limited space, usually have to be constructed as chambers between the fan and coils. Our practice is to line this chamber with 2 in. thick zinc slag wool under perforated metal. Panels for this purpose are commercially available and do an excellent job. Just be careful that the discharge from this chamber doesn't sweep the face of the heating coil before it enters the cooling coils. Your cold deck temperature will be difficult to maintain.

We still use other types of systems and feel that they have a definite purpose. Each job has to be carefully considered and the advantages and disadvantages of each type of system weighed before final selection is made.

NEW GARAGE provides maintenance and parking space for 10 buses, 19 cabs, and three rental cars. Thermostats for garage and office are on each side of wall near office door

Plastic Pipe Radiant Floor Keeps New Garage Warm

Six thousand ft radiant heating system banishes backaches and cold feet and makes bus and cab maintenance easier by keeping temperatures at 70 to 75 F. Two high limit controls in series prevent water temperatures from rising above 120 F.

By Otto Vogt
Heating Contractor

A RADIANT FLOOR heating system using polyethylene plastic pipe, recently installed in a LaGrange, Ill., transit company's new garage, brought comfort to mechanics and made maintenance easier last winter.

Winter, for the garage mechanic, has usually meant backaches and cold feet from long hours under the frozen chassis of a car on a cold drafty garage floor. Those backaches and chilled feet are now a thing of the past for the mechanics of the Chicago suburban LaGrange Cab Co. and the LaGrange-LaGrange Park Transit Co. J. M. Wyllie, who heads both companies, remarked when the new garage was built, "I had dreamed of this radiant floor for 20 years."

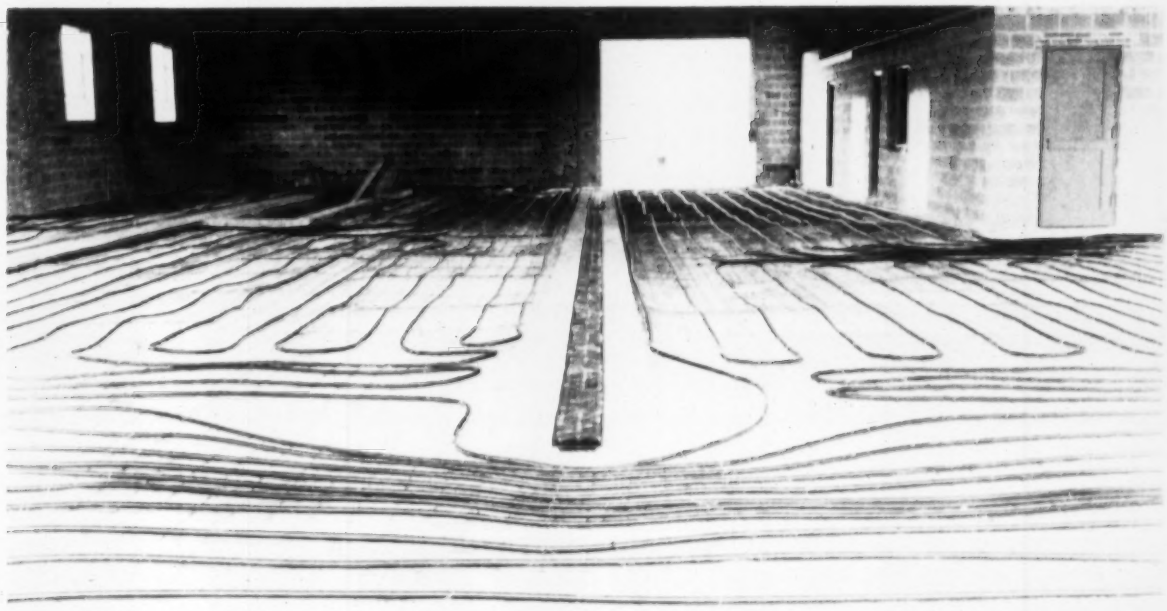
Photos courtesy Crane Co.

The system is designed to keep the maintenance and storage areas of the garage at 55 F and an enclosed office area at 65 F. Even though 55 F isn't room temperature, the warm floor makes life a lot more pleasant for the mechanics.

A total of 6000 ft of plastic pipe is installed, consisting of $\frac{3}{4}$ in. pipe on 18 in. centers in the parking area, $\frac{3}{4}$ in. pipe on 12 in. centers in the work areas, and $\frac{1}{2}$ in. pipe on 6 in. centers in the enclosed office area.

The plastic pipe was rolled out and laid over a gravel base and wire mesh by a two man crew, then covered by a 4 in. concrete slab floor. The only fittings required were polystyrene insert type adaptors that connect the plastic pipe to the headers. The only tools used on the plastic pipe part of this heating system were a saw, to cut the pipe length, and a screwdriver, to tighten the metal clamps holding the pipe to the adaptors.

The polyethylene pipe is flexible,



COMPLETED PIPE LAYOUT shows plastic pipe loops in foreground laid closer together, to concentrate heat at large front doors

needs no couplings, and its light weight makes for easy handling. A 300 ft roll of 1 in. pipe weighs only 60 lb. The two men finished the installation in four days. After the system passed a 125 psia test with flying colors, it was ready for service.

Although the system was designed to maintain a 55 F temperature in the garage, it has been operating at 70 to 75 F because extra pipe and an oversized boiler were installed. Maximum water temperature for the pipe is 120 F. Two high limit controls are installed in series to keep the temperature below this maximum.

Maintenance of the company's cabs and buses has been made easier as the warm floor melts ice and frozen mud off the chassis. To accommodate this melting effect, an extra large drain system covered with two metal grates runs the center length of the building.

The biggest maintenance saving from the new plastic pipe heating system involves winter starting, says Mr. Wyllie. Cabs and buses parked inside on cold winter nights stay warm. Starting is easy, and the repairman has no sludge problem with winter-chilled engines.

"The main thing," he says, "is keeping our men happy, and I think this does it."

The architect was Otto Nerad. 4

TWO MAN CREW, rolling out 1 in. polyethylene plastic pipe for radiant floor heating system, installed 6000 ft in four days

PRESSURE TEST of plastic pipe under 125 psia preceded pouring of concrete. Pipe was attached to headers with polystyrene plastic adaptors

4 IN. CONCRETE was poured over plastic pipe and gravel bed. Air pressure was kept in plastic pipe lines while concrete was poured

Why Waste Money Operating Faulty Piping Systems?

Case Histories from a Consulting Engineer's Files

By C. T. Baker

Consulting Engineer

Hundreds of dollars are wasted in operating faulty piping systems. Here are four such cases of refrigerant piping where trouble was caused by: omission of separate return lines for three compressors; omission of a loop seal water leg at the end of a common drain for four water defrost air coolers; not capping pipe ends and carelessly permitting sand to enter the system; and faulty starting procedure for two compressors which made demand charge cost excessive.

Case No. 1

A COMBINED cold storage and quick freezing plant contained three vertical, single acting, ammonia compressors. One compressor handled the rooms carried at 34 to 36 F, another the low temperature room at —20 F, and the third acted as the second stage machine for the low temperature compressor. Some years after the installation of this equipment, someone in the plant reported to the manager that the water jacket on each compressor was running too warm and that the trouble should be investigated.

Upon inspection it was found that all three of the compressor water jackets were connected in series and that the cooling water supply came from the spray pump on the evaporative condenser. A connection had been made to the spray pump discharge near the condenser and some of the water handled by the pump was being pumped to the compressor jackets.

When the supply and return pipe lines between the condenser and the compressors were taken down, all were found almost completely plugged by deposits carried over from the basin of the condenser. Likewise, the water jackets had accumulated quite a lot of these deposits.

It was necessary to install completely new supply and return lines, and a separate return line from each compressor was extended to the basin of the condenser. Ample water was thus provided to keep the concentration down, as there is now continuous overflow from the basin equal to that supplied to the compressor jackets.

The connection between the spray pump and the jackets was not replaced, as the supply is now taken from the general water system which furnishes the requirements of a large group of buildings.

Case No. 2

A GROUP of four suspended type water defrost air cooling units had the habit of building up frost on the cooling surfaces much more rapidly than occurred in other rooms, where conditions were substantially the same. Investigation brought out that the four troublesome units had a common drain line connecting the drip pan of each unit. This 2½ in. diameter line terminated in a common drain pit in an adjoining room where, among other disadvantages, high humidity conditions prevailed. Also, the lack of a seal at the end of this drain caused a continuous exchange of air between the cold and warm rooms. Air passing through the pipe from the warm room carried both moisture and heat. Only when the coils were water defrosted was there any water in the drain line. Consequently, it was not difficult for warm, moist air to reach the coils of the air cooling units.The trouble was corrected with a loop seal water leg in the line, as shown in Fig. 1.

Case No. 3

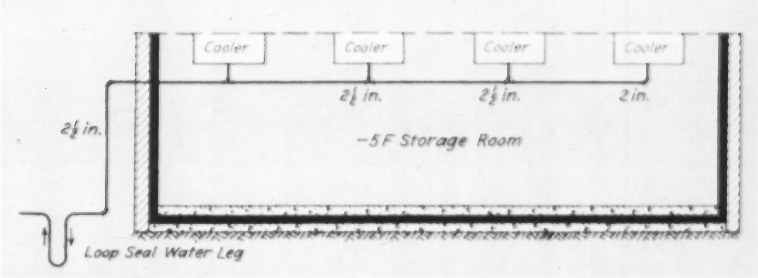
A COLD storage freezer locker plant operator claimed that the solenoid valves installed in his plant were

worthless. There were two refrigerating compressors, one operating on the freezer and the other on the higher temperature rooms. Each was protected against flooding with liquid by a solenoid valve on the liquid supply to the evaporators. The valves were wired in series with the compressor motors so that they opened and closed with the starting and stopping of the compressors in response to predetermined changes in room temperatures.

A few weeks after a highly publicized opening for business in the new plant, the solenoid valves began giving trouble. When the compressors started on the line in response to the thermostats, liquid ammonia from the cooling coils would flood each machine. The immediate reaction was that the solenoid valves were no good and the only thing to do was to take them out of service.

Later, after experiencing several cases of broken compressor valves, an investigation was made to locate the trouble. When the discarded solenoid valves were examined, they were found to have badly cut seats, and several of the thermal expansion valves had been damaged internally.

The mystery was solved when it was discovered that none of the damaged equipment had been protected against injury by foreign matter. Pipe had been unloaded from a delivery truck and thrown on a pile of sand left by the building contractor. As there were no protective caps on the ends of the pipe, each section collected considerable sand, and no effort was made to remove the accumulation before the suction, discharge and liquid lines were installed.



1 FOUR SUSPENDED COOLERS — water defrost air cooling type — had a common unsealed drain which ended in a common pit in an adjoining room where humidity was high. Warm moist air freely reached the coils until a loop seal water leg was installed

Nor had the piping system been blown out with compressed air before being placed in service.

Inevitably, the cylinders of one of the compressors were badly cut, as the suction strainers were incapable of preventing entrance of the fine sand into the compressor. Before this plant could be made to operate properly and maintain correct temperatures, hundreds of dollars were spent in putting the new house in order.

Case No. 4

THE DEMAND CHARGE COSTS paid by an ice manufacturing plant were considered excessive, so, as usual, the utility company which supplied the electric service was blamed. When the situation was investigated, however, some interesting facts were uncovered.

In this plant, two compressors were installed, one driven by a 50 hp induction motor and the other by a 30 hp of the same type. The smaller compressor carried the load about eight hours a day during the summer months. When the freezing tank temperature began to rise, the second compressor would be started and both would operate until the temperature reached the lower point that would permit the smaller being taken off the line. A practice of long standing was to start the large compressor while the smaller one was still running, allowing both to operate about 30 minutes before the smaller unit was stopped.

By changing the starting and stopping procedure, it was possible to materially reduce the demand charge. All that it involved was to first pump the low side down, following the closing of the king valve on the liquid supply, and then stop the small compressor before starting the large one. A substantial reduction in demand charge resulted.

A further improvement was the installation of a full size starting bypass on the small compressor, which had not been so equipped when the unit was installed. There was a consequent reduction in the starting current required to bring the motor and compressor up to normal running speed. ✦

Baseboard Type Radiation Gained Last Year

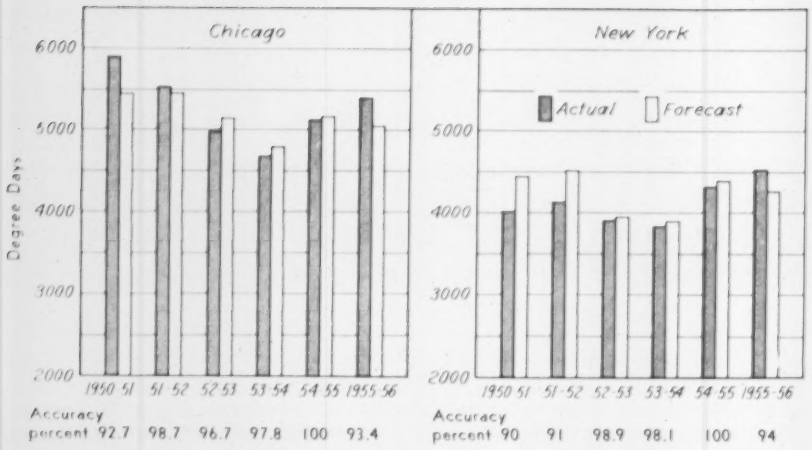
. . . sales increased 37.3 percent

A NEW HIGH in sales of baseboard type radiation was achieved in 1955, with shipments up 37.3 percent over the preceding year, according to the latest figures of the Institute of Boiler and Radiator Manufacturers.

Robert E. Ferry, general manager, also reported gains for the year of 13.7 percent in cast iron boilers and 30.4 percent in industrial type finned tube radiation.

These unparalleled gains for the hot water and steam heating industry sustain earlier predictions that 1955 would be a record year for the industry.

Of the total number of cast iron boilers shipped last year, 94.9 percent were automatically fired. Hot water boilers were 79.3 percent of shipments; steam boilers, 20.7 percent. ✦



1 FORECAST ACCURACY is demonstrated in these comparisons of actual and predicted degree days for six heating seasons — October through March — in Chicago and New York*

Predicting Summer Weather Nine Months Ahead

By Lyle E. Brosché
The Brosché Method

Forecasts of average temperatures April through June and July through September and an estimate of the total number of days in each three month period with maximum temperatures of 90 F and above are available for the first time this year. Summers are getting hotter, says the author.

HEATING, piping and air conditioning contractors, engineers, and others having difficulty in planning their operations by using "normal" temperature forecasting may now derive distinct advantages by using temperature predictions by the Brosché Method, which fall closer to actual than do "normals."

We introduced this method over five years ago to solve the problem of long range temperature forecasting. This method is unlike any forecasting procedures in general use by other agencies in the preparation of long or short range predictions, such as airmass or analogue techniques.

Designed originally with the needs of the heating industry in mind, our forecast operations for the most part have been prepared for the major oil and gas companies. Recently, however, we started making our predictions available to the air conditioning field as well.

Summer forecast information includes:

1) An *indicator forecast* issued on January 15, designed primarily to point to the expected temperature trend. Essentially, this is a forecast issued nine months in advance and consists of two parts:

a) A forecast of the average temperatures, F, for two periods, April through June, and July through September.

b) An estimate of the total number of days during each three month period with maximum temperature 90 F and above.

2) On April 1 a *final forecast* for the two periods shown in the *indicator forecast*. The indicator data is reviewed and refined if necessary.

Only minor changes, if any, are anticipated.

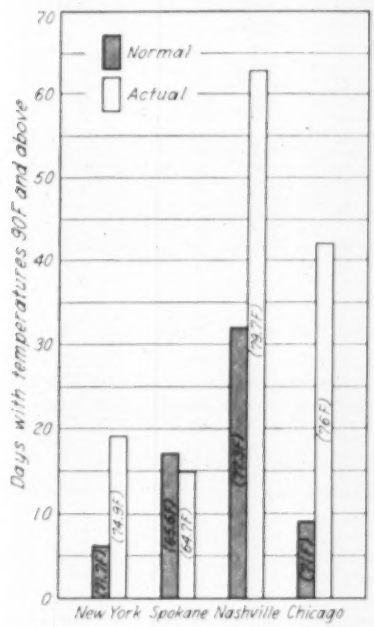
Forecasts may be prepared for any city in the U. S., but as much advance notice as possible is desirable.

Examples of forecast accuracy over the past six consecutive years for the heating industry, for Chicago and New York, are shown in Fig. 1. These are expressed in terms of degree days, and each forecast runs from October 1 through March 31.

How Users Apply It

It would seem this type of forecast could be most useful in scheduling production, estimating sales,

*Brosché Method predictions for the first four years were issued on October 1, giving pinpoint predictions of degree days. Predictions for the last two years were issued on July 15, nine months in advance. This advanced type of forecast, introduced in 1954, covers a 200 degree day range. If the actual falls within the range forecast, the prediction is considered 100 percent accurate. Otherwise accuracy is computed using forecast variation from actual of the nearest range extremity. The top extremity is shown.



2 NORMAL VERSUS ACTUAL number of days with maximum temperatures of 90 F and above are shown here for four cities — July through September 1955. Average daily temperatures for each city for the season are the figures shown in each graph. More than three times the normal number of days were experienced in New York last year; almost five times the normal number were experienced in Chicago; and two less than the normal number in Spokane

budgeting, distribution, and supply units, and for the use of mechanical (heating, piping, and air conditioning) contractors and plant engineers.

Some advantages are as follows:

1) Forecasts showing the variation of temperature over the U. S., and indicating precisely the warmer and cooler — or above and below normal — areas, may be used as a guide for distribution and supply of units.

2) More exact production schedules may result from knowing spring and summer temperature variations. Extreme heat over largely populated areas would call for increased production, whereas, below normal temperatures would result in decreased demand. A much above normal April-June period could indicate early demand, and conversely, a below normal July-September period decreased demand, etc.

3) Volume of business indicated by reference to the forecast may aid the mechanical (heating, piping and air conditioning) contractor in scheduling his work load. Advance knowledge of a forthcoming hot summer, which would place heavy loads on systems and possibly result in greater maintenance, would be useful to plant and building engineers. Examination of wellkept records of unit performances and loads over previous years, compared with expected load and performance during a forecasted hot summer, might even indicate a general replacement of units.

Correlations of past records of temperature — actual temperatures and total days with maximum temperatures 90 F and above over the prescribed three-month periods—with sales, distribution, earnings, maintenance, etc. are made by some users. These correlations are then used in conjunction with forecast data. If required, forecasts may be expressed in terms of cooling degree days computed from any base value considered most useful.

Forecast Trends for Five Zones

Our firm has five forecast zones over the U. S.: Atlantic region, 80 deg W. Long. to the Atlantic coast; Central region, 80 deg W. Long. to 90 deg; Western region, 90 deg to 104 deg; Rocky mountain region, 104 deg to 115 deg; and Pacific region, 115 deg to the Pacific coast.

The normal number of days with maximum temperatures of 90 F and above is compared with the actual number of days these high temperatures were actually experienced in four cities in Fig. 2.

As a general indication for summer 1956, a warming trend is predicted for Spokane, compared to 1955, while a cooler trend is in store for the Nashville area. These predictions should not be construed to mean necessarily above or below *normal* conditions. They reflect only a trend from that experienced in 1955. ‡

Electronic Air Defense Against Atomic Dust

. . . urged for survival

COMPLACENT Americans give scant attention to Civil Defense appeals. Yet defense against atomic dust in the U. S., according to E. W. Meyers, Jr., vice president of the Air Filter Institute and president of Trion, Inc., is imperative for survival.

Mr. Meyers states that electronic air cleaners represent a very practical means for setting up a mass public defense against air borne dust poisoning from atomic bombs.

The nucleus of such protection already exists in the electronic air cleaning installations in offices, plants and commercial buildings, he says.

"However," Mr. Meyers warns, "nothing has been done to organize a civil defense system whereby persons could seek safety from atomic dust falling on our cities in air cleaned buildings or shelters. Nothing has been done to educate building owners so that they can provide their own defenses against this particular phase of atomic attack."

"This equipment shuts out better than 90 percent of all airborne dust and ash down to 0.001 of a micron. Atomic dusts, described by the Surgeon General, U. S. Army, average 0.1 to 10 microns," he says. ‡

Should Airport Runways

PLOWING SNOW from apron at Newark, N. J., airport, pusher pushes snow into temporary storage piles. Mound of snow, background, between plow and plane awaits removal by trucks

SNOW MELTING SYSTEMS for airports, for the most part, are still a thing of the future. But from the present thinking of experts surveyed recently by HPAC — including airport managers, commissioners and directors of aviation, consultants, and designers — many airports of the future will definitely be equipped with snow melting systems.

Not only future airports but some existing ones and others under construction are contemplating the installation of snow melters. Indeed, one airport in the New York City area already has used radiant heating to some degree to control braking action on paved surfaces.

According to the survey, the feeling was almost unanimous that in the long run it would be not only safer and more convenient but cheaper, too, to install ice and snow melting systems in new airports than to rely upon sand, plows, and good old rugged determination. Most managers, if they were to rebuild their aprons, runways, taxiways, and ramps, said they would recommend the installation of snow melters.

Many feel it might be too expensive for existing airports to install complete snow melting systems, but a good percentage mentioned the possibility of installing snow melters in congested terminal areas where the presence of planes and equipment makes it difficult or impossible to plow snow and blow and burn sand into ice.

"Ice Is Biggest Problem Here"

Although few airports are ever completely closed down by ice and snow, many inconveniences generally result, plus the added hazard of airplanes braking on ice. The Minneapolis-St. Paul international airport takes great pride in the fact that it has never been out of service as a result of snow or ice conditions. But it has been able to maintain this record, says Assistant Director L. A. Johnson, only because of the constant vigilance of the equipment crews with their plows and the fact that they stay with it until things are under control.

"Snow is not our biggest problem," says Mr. Johnson,

BURNING SAND INTO ICE following spreading by truck impregnates granules into ice. No really efficient solution has been found for ice, the worst problem at Minneapolis-St. Paul airport

Have Snow Melting?

. . . "Yes!" agree airport managers and other experts surveyed by HPAC. Problems of snow and ice removal differ at various airports, somewhat according to climate and partly because of runway patterns and other variations. But almost without exception, surveyees are giving consideration to snow melting for one problem area or another. Here's what they're thinking.

"since fairly efficient methods have been found to cope with this condition. The real problem is ice, and no really efficient solution for this has been found. Calcium chloride and similar substances cannot be used because of their corrosive effect on aircraft metals. Granular materials coarser than coarse concrete sand cannot be used because of possible damage to jet engines. Loose sand, of course, is quickly blown off by propeller or engine blasts."

To get around this, some airports have devised a means of burning the sand into the ice surface. According to Mr. Johnson, this method is satisfactory and seems the best that anyone has come up with yet. It is somewhat slow and costly, but it does minimize the hazard, he says. In this operation, the sand is spread on the icy surface with mechanical spreaders and is followed up by a burning unit which impregnates the granules into the ice. This burning unit travels at a speed of 3 to 5 mph and is composed of six "weed burners," or large torches, which use No. 2 fuel oil. This burning unit can cover a 35 ft wide strip in each trip and can be supplied directly from a 1500 gal fuel tank trunk which tows it.

The best snow and ice removal system for an airport, Mr. Johnson believes, would be "some method of heating the runway surface to prevent snow or ice from forming, either by internal heating or chemical spray."

"While internal heating would appear too costly from the standpoint of initial investment, it might be cheaper in the long run than present methods," he says. "Certainly it would give considerably greater safety. And, in my opinion, runway snow melting will someday be incorporated in the original design of new runway construction at major air terminals. Only one such all-weather runway would greatly minimize the problem."

Snow removal and ice control in loading ramps and other congested areas around buildings cannot be handled in the same way as on the runways. Burning is impossible. Snow is often bulldozed into storage areas, where it is later loaded and removed.

At the present time, plans are being developed for a new terminal building at the Minneapolis-St. Paul airport. One of the things being considered is heating the loading ramp positions. "I have talked about this for years," says Mr. Johnson. "I can't help but feel that it would be a great saving in the long run and that it would eliminate a great problem."

ATTACKING SNOW PILE, rotary plow blows snow into waiting truck at Minneapolis-St. Paul airport. Snow removal in congested areas near terminal and hangars is especially troublesome. Radiant heating of plane loading ramps is being considered at this field

High Snow Ridges Cut Visibility

Some airports have problems slightly different from those of other fields. The Chicago Midway airport has a runway pattern that is believed different from that of any other major airport in the world. Dual parallel runways in four directions in less than 1 mile square create a multitude of intersections. While this runway pattern makes it possible to handle a terrific volume of traffic in nonblizzard weather, the intersections do cause some trouble, says John A. Casey, supervisor of operations and airports of Chicago's department of public works. "When snow reaches any appreciable depth, high ridges at these intersections are built up when the runways are cleaned," Mr. Casey reports.

"... would recommend snow melters for apron areas"

"A snow melting system would prove very advantageous here. But the present runway system would have to be torn up for the installation and then recovered. Unfortunately, though it would eliminate one major problem, the problem of money still exists. That kind of money doesn't exist in our budget," says Mr. Casey.

Depend on Alternate Runways

While snow and ice have never closed the Willow Run airport of Ypsilanti, Mich., near Detroit, these conditions "inconvenience the airlines and passengers by making it difficult to walk and to push passenger loading platforms and other equipment," says Manager J. P. Weidenbach.

Although parallel runways enable this field to have at least one runway in each direction open so that there is no interruption of service during snow removal, in Mr. Weidenbach's opinion, "an optimum snow and ice removal system would be one where snow would continually melt as it falls and prevent ice from forming."

Similarly, the Greater Pittsburgh airport, among others, depends on the use of alternate runways during snow removal to maintain operations. According to J. B. Sweeney, director of the department of aviation, County of Allegheny, "the airport has never been closed entirely because of snow or ice on the runways." Snow is removed here by snow blowing machines, and for "extreme ice conditions" sand is used.

Snow, Ice Control Temporarily Slows Operations

At the Philadelphia International airport, on the walks, roadways, and areas on the street side of the terminal building, salt, sand, and cinders are used for ice; plowing, loading, and removal is the procedure for deep snow. In addition, an outdoor uncovered pedestrian ramp to the observation deck is kept free of ice and snow by a radiant panel system embedded in the pavement. Incidentally, the terminal building is heated by a hot water floor panel system also.

For ice on the landing area, including runways, taxiways, plane loading ramps, etc., a mixture of sand, fine cinders, and sawdust is mechanically spread where the greatest means of assistance can be given to aircraft using these areas. High speed plows push snow to the edges of the runways, and then rotary plows lift the snow over the lights and distribute it to adjacent grass areas.

It is "extremely rare" for this airport to be out of service because of snow or ice on the runways, says Austin B. Brough, operations manager. But there are occasions when snow and ice control activities may temporarily slow down landing and takeoff operations.

Mr. Brough believes that in snows of any depth "there is no substitute in the foreseeable future" for the plow or rotary method of removal.

"However," he says, "there is very definite need for the development of a method to melt ice and extremely light accumulations of snow without being objectionable or dangerous to aircraft."

Pointing out that rock salt and similar means of melting ice are not permitted where aircraft operate because of the corrosion hazard, he says, "We have often discussed the feasibility of a unit incorporating the principle of the exhaust of jet aircraft engines which could be driven up and down a runway. We have wondered whether such a unit could be practically designed, whether it could effectively melt and dry an ice covered runway, and whether it would be economical enough to justify its use on airport runways."

"Terminal Areas Our Headache"

The biggest snow removal headache at Massachusetts' Logan International airport, Boston, is the ramp and parking areas close to the terminal building, according to Albert L. Edson, manager. He estimates that it takes four times as long and four times as much work to clear this portion of the airport as it takes to clear the runways and taxiways.

With approximately 34,000 ft of 300 ft wide runways at this airport, Mr. Edson finds the quickest way to remove snow is to use plowing equipment, "providing we can get on the runway to remove the snow before it is too deep."

"If we had the money and could spend it," Mr. Edson says, "I would spend it on the ramp and apron areas and on the runway intersections, where snow piles up in double quantities when plows are used."

Along with other managers of completed airports — with runways and aprons stressed for 300,000 lb gross weight — Mr. Edson believes it would be "most expensive, if not prohibitive," to install snow melting. With conviction, he says, "If we were to do it again, I would almost certainly recommend every effort to provide snow removal by a snow melting system on the apron."

Nevertheless, he is realistic about the possible future necessity of installing snow melting in the apron area. "He says, although it would seem impossible now to remove the concrete for the installation of piping or to place an overlay thick enough to bury the piping, I think we may have to consider this some day."

These, then, are the thoughts of men closest to airport operation and design on the present and future possibilities of snow melting installations. Other aspects uncovered in the survey, such as the financial and mechanical problems involved, will be discussed in a future article in HPAC. ⊣

The Law and Your Profits

By William Hurd Hillyer

Customer Is Right, Says Court

. . . when client refuses to pay contractor, claiming air conditioning installation is defective. As a result of a counter suit, contractor must pay client difference between balance due on installation and amount it would cost to remedy defects.

BEFORE going into court for an unpaid balance on work which the purchaser deems unsatisfactory, it might be well to stop and consider. It could be that the customer is right and will produce expert witnesses to uphold his opinion. Had the heating, piping, and air conditioning contractor honestly faced facts in the following case, he would have been a happier man. All names herein are fictitious.

Fred Frigoric, doing business as "Frigoric Air Conditioning Contractors," agreed to furnish and install an air conditioning system in the offices of Dr. Henry Hygena for $2800. Two months after the contract was signed, Frigoric, having completed the installation, requested payment of $600 balance due. The doctor refused to acquiesce, claiming that the system had "innumerable defects" and that the cost of correcting them exceeded the balance named.

This sum was thereupon sued for by Frigoric in the civil district court. By way of retaliation, the good doctor "reconvened," demanding that Frigoric pay him the cost of remedying the alleged defects, namely the sum of $2450.

Frigoric, on the other hand, introduced testimony of another air conditioning contractor to the effect that the system was properly installed without defects of any sort. Conceding that the unit was not producing its rated capacity, the witness insisted that this deficiency could be easily corrected by a simple adjustment costing about $15.

Very different was the testimony of a graduate consulting engineer brought forward by the doctor to substantiate the existence of "defects." Specializing in heating, ventilating, and air conditioning, this expert was of the opinion that the system was not delivering its rated capacity and that the registers in various rooms were too small for the service intended. Furthermore, said he, the ducts were not "constructed or fabricated in conformity with the practices accepted by the American Society of Heating and Air-Conditioning Engineers."

In addition, Dr. Hygena offered the testimony of a sheet metal craftsman, who estimated that the cost of correcting the defects, as recommended by the consulting engineer, would be $645.50.

The trial judge was similarly minded. Convinced that the system was defective, he fixed the cost of correction at $445. He accordingly dismissed Frigoric's "reconvention demand," but awarded him a judgment of only $155, which was the difference between the amount sued for and the cost of correcting the defects. From this opinion the defendant doctor appealed.

The court of appeal "annulled, voided, and reversed" the lower court's judgment in favor of the contractor. Instead, the higher tribunal ordered a judgment in favor of Dr. Henry Hygena and against Fred Frigoric for the sum of $45.50, with legal interest and all costs, including an expert's fee of $100. That is to say, the air conditioning contractor by this ruling found himself saddled with at least a $200 judgment. The learned justices reasoned:

Though the doctor no doubt derived substantial benefit from the air conditioning, "we are equally convinced that the system reflected defective installation and, in consequence thereof, inadequate, inefficient, and unacceptable performance." The consulting engineer's expert testimony impressed the appeals court as "the most credible and professional testimony on record."

The sheet metal man's estimate of $651.50 was accepted by the higher tribunal. Deduction of the $600 balance gave the sum awarded — $45.50 — to Dr. Hygena plus costs and fees. Carelessness on the contractor's part had taken money from his pocketbook and stolen his time, besides detracting from his reputation.

[Note. While this discussion applies to an actual case, it should be remembered that legal rules vary in different states.]

WILLIAM HURD HILLYER, author of this regular feature, is a contributor to a number of banking and financial publications and has written several books on business. A former vice president of the Atlanta Trust Co., his work there gave him a practical legal background.

Do "Base Bid" Specifications Reduce Costs, Improve Quality

. . . of heating, piping, and air conditioning jobs?

"Yes!" declares Kenneth M. Wilson, chief of the electrical and mechanical engineering division, E. F. Klingler & Associates, Architects, whose firm writes this type of spec almost exclusively. In this controversial article, he discusses not only the pros and cons of the "base bid" spec but those of the "open bid" and "bidder's choice" specs as well.

Also in favor of the "base bid" is Lee P. Hynes, consulting engineer, whose comments are published with this article.

Opposing all three of these types of specs is Anthony G. Ratkus, mechanical engineer with a government agency, whose comments also appear. He suggests instead a "semi-open" method of writing specifications.

By Kenneth M. Wilson

SPECIFICATIONS today, in many cases, are no longer worthy of the definition. They have degenerated into an uninteresting, unenlightening, and too often a badly written piece of technical prose.

The word "specification" is defined as "definite or determinate;" "distinctly and plainly set forth;" "to mention specifically;" "to state in full and explicit terms;" "a definite and complete statement, as in a contract." These definitions are positive. They emphasize that whatever article or process is being described is being confined to a particularly narrow field. There is no hint of an all-encompassing scope.

Yet today on nearly any project, in the wide range of bids received, proposals may vary as much as 100 percent between the high and low bids on any given segment of the work. And in example after example of poorly constructed buildings, the efforts of good designers have been wholly wasted by the failure of the specification writer to be specific.

Heating, piping, and air conditioning specifications can be divided into three general classes.

1) The "open" specification, in which minimum standards of quality and performance are set forth, and any piece of equipment or material which complies with these minimum standards is acceptable. This type is most commonly found in U. S. Government work.

2) The "bidder's choice" specification, in which three or more brands of any given piece of equipment usually are named and described, the choice being left with the bidder. This is the most common of all types today, particularly on public work.

3) The "base bid" specification, in which the various items of equipment are concisely described, their performance defined, and the manufacturer's name and catalog designation clearly set forth. The base bid must include only the articles specifically named, and if other brands of equipment are to be offered, they must be done so on an alternate proposal.

The underlying difference in all these types of specifications is the application and interpretation of the word "equal." How does one determine what is the

This article is abstracted from a speech given by the author at the second annual Heating and Air Conditioning Conference last year in Salt Lake City, Utah, sponsored by the University of Utah College of Engineering, the American Society of Heating and Air-Conditioning Engineers and the American Society of Mechanical Engineers. Later he gave the speech before the Illinois chapter of the ASHAE. His outspoken views on the subject immediately attracted national interest, which has increased in recent months.

"equal" of anything else? To find an answer to this perplexing question, we made a comprehensive study of specification writing. Perhaps our experience will be helpful to others who face the same problem.

Our firm of fewer than 20 people engages in architectural and engineering work of all types of buildings. In the last several years, educational plants have been a major part of our work. But we also design commercial and industrial buildings, as well as churches, hospitals, office buildings, courthouses, and others. We seldom are required to retain the services of other consultants to supplement our own staff. Thus, our specifications cover a wide field, from the conception of the plan to the completion of the building and installation of mechanical and electrical equipment. After construction, we are often asked to set up preventive maintenance programs for the operation and maintenance of buildings and their equipment.

Our experience with the "open" specification has been relatively limited, since we do not solicit nor engage in any volume of work for the federal government. We have had rather broad and often unsatisfactory experience with the "bidder's choice" specification. Almost exclusively, we use the "base bid" type of specification. Our experience has been so satisfactory with this specification that we have proved to ourselves and our clients that substantial reductions in overall costs, and improved quality of finished work, can be obtained more consistently with this type of specification than with any other.

"After switching from 'bidder's choice' to 'base bid' specs in 1950, our firm immediately experienced a substantial cost reduction in its average cost of school construction. From a range of $11.50 to $14.20 per sq ft (almost exactly the national average at the time), our costs dropped to a range of $8.65 to $11.70 per sq ft, when the national average was $25.73 per sq ft.

"In 1953 we designed an elementary school — one of the finest educational plants in Wisconsin — at a cost of $12.10 per sq ft, or $17,700 per teaching station. At the same time other schools were being constructed in the same area under 'bidder's choice' specifications, of substantially the same size, design, and finish, but the costs were running from $22,000 to $26,000 per teaching station.

"There is no magic or secret in the attainment of these cost figures. Definite specifications have permitted us to present greater detail on our drawings. Abandoning of the questionable virtue of impartiality has enabled us to name the products we want, and to design around these products to take the fullest advantage of every characteristic they possess. Clean, sharp, well detailed drawings, combined with clear, tight specifications have all but eliminated the staggering item of contingencies in bids. Extras have been reduced to less than ½ of 1 percent."

1. "Open" Spec Is Too Descriptive, Costly

The so called "open" specification was conceived for the purpose of enabling the specifying engineer to maintain complete impartiality between the various manufacturers and suppliers of equipment. In this type of specification it is necessary to prepare and present complete and comprehensive detail on each item. For example, in a heating unit, coils must be described in terms of heat emission, heat exchange, heating surface, and entering and leaving air temperatures to establish the capacity characteristics. Also included must be an equally comprehensive definition of the materials of the coil, the method of fabrication, the sealing of connections, specific data on fins, tubes, headers, and tappings. Cabinet enclosures must be similarly described. This entire descriptive process must be repeated in varying form hundreds of times in the average volume of specifications to cover the multitude of items that comprise the whole specification.

This type of specification is costly to prepare because of the study required to formulate the description so as to eliminate inadequate apparatus and yet leave the specification open enough to admit the products of all suppliers. Very often, the "meat" of the specification is lost in the multitude of words that it takes to write an "open" specification.

Since the designer cannot possibly know the exact nature of the apparatus which will ultimately be furnished, he cannot be firm in his details. So-called equal products vary from one another in dimension, in points of connection, in control cycle, and in physical appearance. If special foundations are required for a given piece of equipment they cannot be detailed until after the award of the contract. If a unit is to be suspended from structural members, supporting members cannot be shown in detail, as they vary from one make of unit to another. In today's building, where space is so scarce, the size and arrangement of rooms are often determined by the character and size of the equipment they will house. The "open" specification definitely makes the designer's job more difficult and tends to increase the field supervision of the work to a point all out of proportion to the primary design.

Another objection is that the technical performance and quality of many brands must be checked carefully for each unit offered, in order to determine if the units proposed will meet the minimum requirements of the specifications. This is time consuming and therefore costly.

While an "open" specification admits bargaining between various suppliers, this is a questionable asset at best. For the bidder must estimate auxiliary costs such as connections, installation, and controls separately for each brand considered. His cost of preparing a bid must therefore be higher than with either a "bidder's choice" or "base bid" specification.

Furthermore, since the basic plans cannot be complete in detail, substantial contingencies must be included in his cost to cover indeterminate items which can be specifically defined only after the selection of equipment is approved by the specifying engineer.

In an "open" specification, basic plans are necessarily lacking in detail. Detailed plans in most cases are prepared wholly or in part by the manufacturer of the equipment and are concerned only with the immediate problems of that particular piece of equipment. It then becomes the tradesman's and field engineer's responsibility to coordinate the installation work between two or more sets of plans for each unit.

The owner can express no preference, if he has any, on the type of equipment he will buy. The lack of precise definition in specifications invariably results in numerous "extras" which often offer a handicap in financing.

The only specific merit of an "open" specification seems to be that it does not discriminate against any supplier. In view of all the problems, this virtue appears to be of questionable value.

2. "Bidder's Choice" Is Restricted "Open" Spec

The "bidder's choice" specification is nothing more than an "open" specification which limits the contractor's choice of equipment to two or three brands, which have been predetermined to be acceptable to the designer. While all of the objections raised to an "open" specification are present in this type of a specification, they are more limited in scope and thus create proportionately less of a problem to all concerned. However, this type of specification points up another problem that is particularly objectionable to manufacturers.

Everyone has heard the old axiom: "One rotten apple will spoil the whole barrel." Our experience has been that 19 out of 20 contractors and bidders are basically honest and ethical. The 20th bidder is not always endowed with these attributes. It therefore follows that any specification must be set up to protect the owner against unfair and unethical practices of this type of bidder.

With three or more brands of an item named in a specification, a contractor will, very naturally, use the price of the least costly brand in assembling his bid. If the contractor is successful and is awarded the contract, in most cases the lowest bidder of the three is given an order at once. However, the one contractor out of 20, instead of placing his order for equipment with the low bidder, will begin to shop between the suppliers on the assumption that subsequent approval can be obtained. Often the "lucky" supplier has to cut his price to a point where he no longer has a profit. His selling expense has doubled and sometimes tripled. While all this shopping has been going on, time has been passing, and invariably immediate delivery is almost essential. In most cases, a manufacturer will not extend himself too much to expedite a nonprofit order. This condition then provides a hand-

• "base bid spec practical" — Lee P. Hynes

I AGREE with Kenneth M. Wilson about the advantages of "base bid" specifications, with provision for alternate materials, under competent engineering approval. While my own practice does not lie primarily in the field of schools or similar buildings, but rather in large power and industrial process projects, the specification problems presented by Mr. Wilson are common to all types of engineering work.

A large project is usually quite complicated, and each major item of special equipment must properly perform its function, or it will prove a weak link, which can be very costly.

The "base bid" specification offers the best protection to the owner and aids the honest contractor in making a fair bid. The responsibility for approving alternate materials rests properly on the owner or his authorized representatives. This approval of alternates is often a vital factor in getting a good job of construction.

In some cases, carefully prepared specifications are upset by the action of the owner, in permitting inferior alternates without giving them adequate engineering analysis. Failure of unsuitable alternates, when put into service has caused long delays and a heavy cost for replacement with the suitable items which were originally specified on the basis of their proven reliability for the particular service. Instead of saving money, the unwise choice of alternate materials can prove expensive to the owner.

In my judgment, one cause for such trouble lies in the shortage of enough engineers who are qualified by training and practical experience to properly evaluate the overall results of making this kind of changes from the specifications.

In too many cases, the engineering department is subordinated to the purchasing department and first cost is sometimes given preference over the engineering considerations. Overall management needs to keep these factors in their proper balance.

Management should use great care in selecting its engineering advisors; having done so, it should not lightly overrule their considered judgment.

I believe that the "base bid" is the most practical type of specification, if it is fairly drawn up and properly administered. Other types of specifications have more loopholes and are harder to bid, evaluate, and administer. ‡

made opportunity for the contractor to attempt a substitution, usually at a handsome profit to himself. If a substitution is not accepted, it becomes the engineer's responsibility to attempt justification of a job delay.

There has been nothing constructive accomplished by this byplay, for the engineer, the supplier, or the owner. As far as the contractor is concerned, job delay usually eats up any additional profit obtained through these manipulations of orders and specifications.

In some cases, contractors are obliged by specifications to list their suppliers and submit such list with their bids. This does assist in preventing shopping and promiscuous substitutions. However, it does not relieve the problem of deferring much of the detail work until after the award of contracts, and in this respect is no improvement over the "open" specification.

It is true that less technical detail and description are required in the body of the specification than with an "open" specification. It is also true that architectural plans and layouts can be prepared with less latitude to allow for variations in equipment.

This type of specification, on the whole, is somewhat more satisfactory than an "open" specification in that it does establish more limitations on the contractor and does tend to narrow the range of bids. Field supervision is less costly and more effective. We do not have any specific data on the cost relation between these two types of specifications, but our experience has been that as a general rule, the more limiting and defining a specification, the better the utility and appearance of the finished job.

3. "Base Bid" Spec Names Equipment Exactly

The "base bid" specification is one where each item of equipment is clearly defined as to quality, capacity, function, and performance and in addition is specifically identified with the manufacturer's name, model number, catalog listing, and size. Under this type of specification, the bidder has no choice of equipment under his base bid. All contractors must bid on the exact equipment named, except as supplementary instructions established in the specification will permit.

Under this type of specification, base bids are usually confined to a narrow price range. The only variable factors involved are quantities of miscellaneous supplies and quantities of labor. Furthermore, under the "base bid" specification, each contractor knows exactly what he must furnish. He also knows that his competitors must furnish exactly the same items. The architect and owner know exactly what will be received for a given cost.

This complete and confining definition of equipment permits the designer to accurately and clearly locate and detail all foundations, piping connections, ductwork, and controls. It permits the exact calculation of dimensions. Furthermore, since shopping for price is almost completely eliminated, unnecessary delays in construction are minimized. Also, suppliers of equipment and material can

• "study semi-open bid" — Anthony G. Ratkus

I DO NOT AGREE that the "base bid" method of writing specs is the answer to a good specification. In fact, I think it is a step in the wrong direction because the "base bid" spec:

1) Definitely restricts bidding.

2) Is considered a "gravy" spec by the supplier of equipment; as such, the profit on an item is raised to compensate for the jobs in which he is confronted with competitive bidding.

3) Gives the engineer justification for foregoing any study or investigation into the quality and specific performance required of any piece of equipment or material.

4) Opens the way for endless differences of opinion over what is an alternate proposal in regard to quality and performance.

5) Has a tendency to support collusion between the designer and the manufacturer.

In my opinion, the answer to writing a good, competitive type of specification that will help to promote a good design does not lie in "open," "bidder's choice," or "base bid" specs but in the "semi-open" method.

The "semi-open" spec requires considerable initial study and constant vigilance for new developments. With this type, the engineer does not have to take what the manufacturer gives him. He can compile a composite of many of the good features of an item and, within reason, specify them if they are not patented and insist on such a product.

The "semi-open" method works something like this. Assume there are 20 manufacturers of an item. The first seven on the list make a product which the engineer knows is the best product from past performance and experience. The engineer would specify the quality of material and performance which could be met. The contractor would submit one of the seven highly competitive manufacturer's items, and the remaining 13 would also try to comply with the specs.

On the other hand, suppose the designer realized the particular system he is designing is only a temporary installation. He could, with justification, specify the quality of material and performance of the first 18 on the list. Chances are, he may end up with a cheaper product which may not last as long as the first seven on the list but, under the circumstances, it would save the client money. ‡

bid at a reasonable profit and, hence, are most cooperative on delivery, guarantee, and service. Contractors are competing only on material quantity and labor. Hence, the chance of error in bidding is diminished. A fair profit to all concerned is probable. The finished work will always reflect the pride of the contractor in a profitable venture.

There are however, some hazards involved in the use of "base bid" specifications. One must guard against loading of the price by the suppliers of specified equipment. The most effective weapon we have found to combat this hazard is to call for alternate bids on comparative items, wherein differences in prices are reflected by additions to or deductions from the base bid. The acceptance of an alternate bid where the price justifies it will do wonders to keep the suppliers of specified equipment honest and competitive in their prices.

Under a "base bid" specification, the selection of the exact kind of equipment to be used is not within the province of the contractor but rests jointly in the hands of the architect, engineers, and owner. If there are price differentials, the owner receives or pays the difference if he chooses to accept alternate proposals. If the acceptance of an alternate will require design changes, extra costs on the part of other trades, or additional engineering, the costs of these changes can be established and a true evaluation can be made on the worth of an alternate proposal, prior to its acceptance by the owner.

Naturally, there may be very legitimate reasons for any contractor to object to using the products of the manufacturers named in the base bid. The contractor might be involved in difficulties on another job where the same equipment was used, and he might not be willing to accept the responsibility of guaranteeing his work if a brand of equipment in which he had no confidence was required. Personality differences between contractor and supplier can sometimes assume unusual proportions. Therefore, it is incumbent upon the designer to make some provision for a change in "base bid" specification upon request of individual contractors. Procedures for changes of this sort should be set up so they require a certain amount of documentary work from the contractor to discourage changes unless there is unusual justification.

Opportunities for offering alternate brands and types of equipment for the architect's and owner's consideration should be incorporated into the specifications in a manner which will encourage and simplify the presentation of alternate bids.

If plans are prepared in the detail that a base bid specification will permit, the accuracy with which a bidder can estimate his work is increased a hundredfold. Contingencies to cover questionable items are all but eliminated. The savings thus obtained will more than offset a reasonable profit factor for all concerned. While the designer must spend more time in preparing drawings, the reduction in the time required for field supervision more than offsets this cost. Extras are almost eliminated.

The most common objection to a "base bid" specification is that it is no longer an impartial specification. The very act of limiting the "base bid" to a specific product implies a definite preference on the part of the designer. Continued use in a series of specifications of the products of any one manufacturer will invariably result in the engineer being accused of collusion with the manufacturer, and sooner or later he will have to defend himself against the stigma of being a commission man. To the professional engineer or architect, this matter is one that must be considered. It is a calculated risk and must be evaluated and weighed against the obvious advantage of the "base bid" specification.

Reports from hundreds of contractors in all branches of construction show conclusively that they welcome a tight specification, provided that it is enforced as rigidly as it is written. Very few contractors will deviate from, or attempt to evade, a well written specification. When this does occur, the architect and engineer should insist on compliance with both the letter and intent of the contract specifications.

Our specifications are welcomed by all suppliers, whether their product is named in the specifications or not, and the competition between suppliers is keen. Price cutting is not the prevailing practice but rather the exception. Our answer to charges of collusion or commission is to point to the final total cost of our buildings, and these figures permit no argument.

Questioned on the legality of the "base bid" specification, we have diligently searched the statutes. Except for limitations on certain types of federal work, we have found nothing to limit the use of this type of specification. While a substantial part of our work requires expenditure of public funds, our specifications have never been successfully challenged. Part of the reason is the care with which we have written the paragraphs in our specifications dealing with "Materials of Approved Equal" and "Substitution of Equipment." The exact wording of these paragraphs are, in part, as follows:

"Materials of Approved Equal"

"Where items of equipment and/or materials are specifically identified herein by a manufacturer's name, model or catalog number, only such specific item may be used in the base bid, except as hereinafter provided.

"If contractors wish to use items of equipment other than those named in their base bid, contractor shall apply in writing to the architect for approval of substitution at least six days prior to opening of bids, submitting with his request for approval complete descriptive and technical data on the items or item he proposes to furnish. Approval for changes in base bid specifications will be granted only upon individual request of prime bidding contractors. No blanket approvals for substitutions will be granted to suppliers, distributors or subcontractors.

"Unless requests for changes in base bid specifications are received and approved prior to the opening of bids, as defined above, the successful contractor will be held to furnish specified items under his base bid. After con-

tract is awarded, changes in specifications will be made only as defined under 'Substitution of Equipment.'

"Items of equipment of the contractor's choice may be offered as alternates to the items named in the specifications, either in the spaces provided for same in proposal forms, or if no space is provided, on the bidder's letterhead. Alternate proposals must be accompanied by full descriptive and technical data on article proposed, together with statement of amount of addition or deduction from base bid if alternate is accepted. Prior approval by architect is not required on items submitted as alternate bids."

Note that no one is denied the opportunity of bidding as no approvals are necessary to submit alternate proposals.

The paragraph on "Substitution of Equipment" is as follows:

"Substitution of Equipment"

"After execution of the contract, substitution of equipment of makes other than those specifically named in the contract documents will be approved by the Architect for the following reasons only:

"a) That the equipment proposed for substitution is equal to and/or superior to equipment named in construction, efficiency and utility, and further that the equipment named in the specifications cannot be delivered to the job in time to complete the work in proper sequence to work of other contractors, due to conditions beyond control of the contractor.

"To receive consideration, requests for substitutions must be accompanied by documentary proof of equality of difference in price and delivery, if any, in form of certified quotations from suppliers of both specified and proposed equipment.

"In case of a difference in price, the owner shall receive all benefit of the difference in cost involved in any substitution, and the contract altered by change order to credit owner with any saving so obtained."

This article takes all the profit and all the fun out of shopping and promiscuous substitutions.

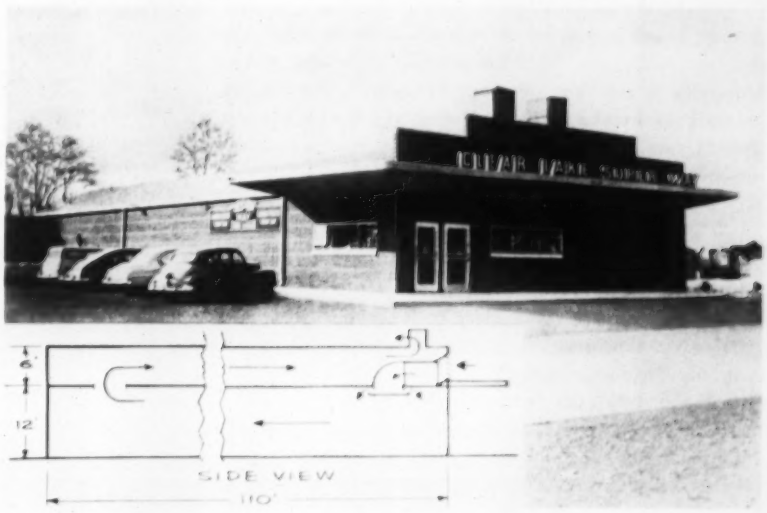
We do not hesitate to use a new and often untried product in our base bid, if it has the backing of a manufacturer whose reputation for honesty and integrity is above reproach. To be truthful, the reputation of the manufacturer is more important in the selection of a base bid item than is the item itself.

All of these values must be weighed when the engineer sets up his base bid, with its implication of "preferences." An honest preference, honestly arrived at, should be expressed and defended instead of being hidden in the subterfuge and hypocrisy which has been misnamed "impartiality." ✣

Two-Pass Air System Economizes Heating, Ventilating

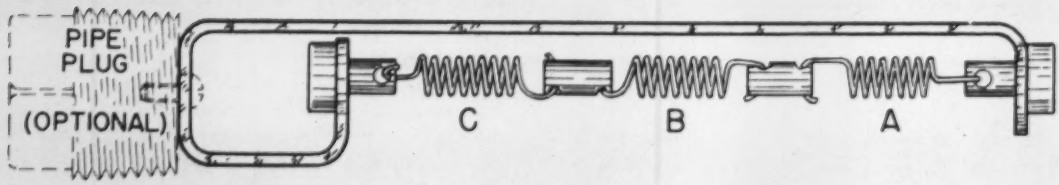
. . . exhausts air through food store attic

An ingenious and economical solution to the ventilating and heating problems that confront many food and other retail stores is offered in F. F. Van Der Wal's Super-Way food store, Springfield, Ill., according to the Ilg Electric Ventilating Co. The current of air passing through the building performs two functions: on the first pass, the air ventilates — or heats — the main floor; on its second pass, in the opposite direction, it goes through the 6 ft high attic. This second pass is valuable in both summer and winter. It does not permit the accumulation of sun heated air in the attic during hot months. In winter, it provides a warm attic and consequently less loss of heat through the ceiling of the store.



Air is drawn in at the front of the attic and passes through two air makeup units equipped with filters and heating coils. The air then enters the store proper through a diffuser equipped with a baffle plate and passes the full length of the store. This system has successfully provided protection against stale air pockets and accumulated food odors. At the rear of the store the air passes up into the attic through three grilles that cover almost the entire width of the building. The air then moves through the attic to two small "penthouses," where it is exhausted by direct connected propeller fans.

The system provides a complete air change every four minutes. ✣



NDHA TESTER — comprised of helical wire coils electrically insulated from each other and the supporting frame — makes possible the measurement of corrosion under actual operating conditions in 30 days or less

Practical Corrosion Engineering Pays with the NDHA Tester

Here are the results of eight years' experience with the National District Heating Association's corrosion tester as reported by typical users in heating plants, air conditioning systems, and industrial processes.

By Leo F. Collins

Director
Water Doctor Laboratories

A FEW YEARS ago a few wellknown authorities revealed that corrosion was "shaking down" American process industries to the tune of about $7 billion annually. Apparently this revelation had the effect of a double barreled shock treatment on the barons of business because two improvements have since become evident. The indifference that once was the trademark of many front offices has given way to an attitude of concern, and the cash necessary to cope with such problems has since been released a little less grudgingly than heretofore.

That the process industries will benefit from this renaissance is certain. But that process engineers will reap any dividends immediately is not so evident. In the "good old days" the front office could be indicted, at least to some extent, for the persistence of intolerable conditions, but the "new look" has cast the process engineer as the only one, normally, on stage when corrosion problems are presented.

No one appreciates this situation more keenly than process engineers. They know, too, that any device that will warn of troubles, enroute, will meet their needs better than one capable of a high degree of precision that requires a battery of specialists to manipulate.

Mr. Collins, a member of HPAC's board of consulting and contributing editors, is a recognized authority on corrosion problems.

Data Collected from Growing Use of NDHA Tester

A device of this type — the National District Heating Association's corrosion tester, consisting of three helical coil specimens electrically insulated from each other and the supporting frame, as shown in Fig. 1 — was described in the October and November 1948 HPAC's. Directions for its use were outlined there, and considerable data was presented. For the most part, these presentations were a compendium of the author's experience with the device.

However, these articles stimulated considerable interest in practical corrosion engineering. Over 1500 requests for reprints were received, a wide variety of engineers "tried out" the tester, and about one-third of the latter submitted their findings for interpretation or review.

Conceivably this data, collected by many investigators and from many sources, is better than data derived by only one investigator. This article is therefore a report and a summary of this information.

"Omitted" Deaerating Devices Cause Corrosion

The ultimate performance of every processing system is dependent upon the competency of its designers, the integrity of its installers, and the faithfulness of its op-

erators. These realisms are brought into focus by comparing the corrosion troubles experienced by two hot water heating systems, designed by the same engineers but installed by different contractors in different cities. One was in a large modern dormitory building on a college campus, the other in a monumental high school of an elite suburb of one of our largest cities.

During the second heating season, failure due to pitting became frequent in the college dormitory system. Testers installed at key points in this system gave the results noted as Measurements 1 and 2 of Table 1. Simultaneously testers installed in the high school system gave the results noted as Measurements 6, 7, and 8 of Table 1. The latter measurements revealed much lower corrosion rates.

Upon further investigation it was discovered that in installing the college dormitory system the contractor had "omitted" the deaerating fitting on the discharge side of the converter and also some of the air release valves specified at key points in the system.

After these had been installed, a tester at the original test spot in the system gave results much lower than the original ones. See Measurement 3 of Table 1.

Following Measurement 3, the system was shut down for the summer. When it was started in the fall, another tester was installed and gave the results noted as Measurement 4, or almost as high as the initial measurement. An investigation revealed that, in shutting down the system, the deaerating fixture on the converter had been valved off and not reopened in the fall. When the latter was done, the result vastly improved, as Measurement 5 shows.

Tester Shows Refinery Process Water Corrosive

A large oil refinery had put into operation a "water flood" to increase oil recovery. Initially fresh water from two wells was employed. As the flooding operation progressed, the recirculated water became highly mineralized. Since some of the equipment handling this water was of black steel, it was determined to check the corrosivity of both the wells and the recirculated water. Water from Well No. 2 was found to be three times as corrosive as water from Well No. 1, and the recirculated water was about 21 times as corrosive as water from Well No. 1. See Table 2.

Because of the high corrosivity of the recirculated water, a program had to be devised to prevent building up the high concentration of corrosive minerals.

TABLE 1—COMPARATIVE CORROSION measurements in hot water heating systems are shown here for two installations designed by the same engineers but installed by different contractors. In the dormitory system, several deaerating devices were "omitted" during installation

Measurement No.	Building	Corrosion Rate* Shown By Coil C	Coil B	Coil A
	College Dormitory			
1.	Initial Measurement	22.5	27.8	26.0
2.	Check of Measurement 1	19.6	20.0	21.0
3.	After Deaerator Installed	3.7	4.1	4.1
4.	After Deaerator Shutoff	21.2	19.6	21.0
5.	After Deaerator Returned to Service	2.1	1.7	2.0
	High School			
6.	Water In Zone A	0.7	0.9	0.6
7.	Water In Zone B	1.5	0.8	1.4
8.	Combined Water Zones C and D	0.5	0.1	0.1

*Corrosion rates are expressed as inches penetration per year × 1000. Values of the order of 20 and above indicate troubles.

TABLE 2—CORROSIVITY of fresh vs recirculated water used to increase oil recovery in a refinery is shown here

	Corrosion Rate* Shown By Coil C	Coil B	Coil A
Well No. 1	5.4	4.0	5.7
Well No. 2	9.4	11.6	12.5
Recirculated Water	57.4	59.1	54.6

*Expressed as penetration in inches per year × 1000.

Tester Measures Effectiveness of Inhibitors

One of the more frequent uses made of the corrosion tester has been to gage the effectiveness of chemicals represented as corrosion inhibitors when added to processing waters.

An interesting comparison is the results obtained by two different concerns in a southwestern state which were troubled with scale formation in the water cycles of their air conditioning systems. Both used the same raw water supply, but each contracted with a different specialist to condition the water. The results obtained as shown in Section A of Table 3. Treated water of the utility company's system was 20 times more corrosive than the other.

Subsequent investigation revealed that the "inhibiting chemical" used in the utility company's system was a crudely proportioned mineral acid. Its use was promptly abandoned.

In the air conditioning systems of two manufacturing plants, it was decided to measure the effectiveness of treating the recirculated water and also to check upon the corrosivity as influenced by heat. The results are shown in Section B of Table 3.

In the case of the Wisconsin plant, it is clear that the water needed treatment, and that the treatment was effective. In the case of the Ontario plant, the necessity for treatment seems questionable and the effectiveness of the inhibitor seems doubtful.

Improve Processing Cycles After Testing

In Table 4 are catalogued measurements made in the processing cycles of four different plants, and in the condensate return lines of a variety of buildings.

The dry ice manufacturer was exasperated at first because the tubes in the "reboiler" were failing about nine months. He was experimenting with an inhibitor. With intermittent feed of the inhibitor, the tube life was extended to about two years. After three years of proportioned feed, no failure had been experienced.

In the case of the ice making plant, the system contained about 100,000 gal of inhibited NaCl brine. This brine was force-circulated through "cans" suspended in steel frames. It was imperative that the brine be inhibited so as not to corrode the frames or cans. Accord-

TABLE 3—EFFECTIVENESS OF CORROSION INHIBITORS is shown here for water used in the air conditioning systems of two office buildings and two manufacturing plants

Section A

	Corrosion Rate* Shown By Coil C	Coil B	Coil A
Public Utility Office Building			
Untreated Water	0.4	0.5	0.4
Treated Water	82.0	80.0	96.0
Commercial Office Building			
Untreated Water	0.9	0.7	0.9
Treated Water	4.4	4.2	4.0

Section B

	Corrosivity* Of Water Before Treatment	After Treatment
Manufacturing Plant in Wisconsin		
Influent of Heat Exchanger	27.4	14.7
Effluent of Heat Exchanger	56.0	14.4
Manufacturing Plant in Ontario		
Influent of Heat Exchanger	8.5	4.8
Effluent of Heat Exchanger	9.8	9.3

*Corrosion rates are inches of penetration per year × 1000

ing to the process engineer in charge. "The tester proved the treatment adequate."

The paper manufacturer was experimenting with a process change and wanted to know if the proposed changes increased the corrosivity of the slurry so that it could not be handled with conventional equipment. From the values obtained upon consecutive measurements, it was concluded that his contemplated process change proposed no corrosion problem.

The measurements made of the corrosivity of the drains from a reheat coil of an air conditioning system in the office building of a large cigarette manufacturer explained the frequent failures of the lines.

The data showing the measurements made in condensate lines has been included to reflect the types of engineers that are finding the tester helpful.

Compare Resistances of Various Metals

An obvious further use of the corrosion tester is to test the comparative corrosive resistances of metals and materials commonly used in heating, piping, and air conditioning systems. Without an actual test of the corrosion resistance of any particular metal in a particular service, this cannot be determined. This has been demonstrated in a number of cases with which I am familiar. One such example involves the pipe lines for a domestic hot water circulating system and condensate return lines in several buildings in a large university.

In presenting these findings, the aim is to provide criteria that will permit the process engineer to judge whether or not the corrosion tester can be of help to him as a diagnostic tool.

The corrosion tester:

- Can be manipulated without special skills.
- Gives reliable results in far less time than any other known method of corrosion measurement.
- Makes its measurements under actual operating conditions.
- "Checks" its own findings.
- Is not expensive to employ. ‡

TABLE 4—PROCESSING CYCLES in various industries, as shown here, have been given greater efficiency and longer life after corrosion revealed by measurement was reduced

	Corrosion Rate Shown By Coil C	Coil B	Coil A
Dry Ice Manufacturers — Reboiler			
No Inhibitor	30.7	37.6	35.3
Intermittent Inhibitor Feed	24.6	30.4	30.4
Continuous Inhibitor Feed	14.6	14.8	14.6
Ice Making Plant			
Inhibited Brine — Cycle	2.7	3.6	2.7
Paper Manufacturing			
Process Line — 1st Measurement	8.0	7.6	6.0
Process Line — Check Measurement	8.1	6.6	6.0
Air Conditioning System			
Drains from Reheat Coils	29.0	25.7	28.7
Condensate Lines			
College Laboratory Building	8.4	6.4	6.7
Drug Manufacturer's — Plant	17.5	18.1	18.8
Drug Manufacturer's — Office	18.4	15.2	15.0
Ammunition Depot	11.5	10.0	13.0
Can Manufacturers — Steam Plant	5.0	2.9	5.5
Cigarette Manufacturer — Window Coils	12.8	14.5	15.3

To Cut Business Costs, Emphasize Cost Concern

. . . rather than cost reduction

IF YOU WANT to cut business costs, you should involve your employees in a "cost concern" program, rather than a "cost reduction" campaign, says Robert C. Hood, president of Ansul Chemical Co., of Marinette, Wis. Ansul has 550 employees.

In a talk before a recent American Management Association personnel conference, Mr. Hood reported that his company, by encouraging employees to concern themselves with the problem, was able to reduce its costs to such an extent that profits after taxes increased by 40 percent and company stock appreciated by 30 percent over the previous fiscal period.

Both these achievements were all the more remarkable, he pointed out, because they were accomplished during a period when sales were showing a 9 percent decrease. "Furthermore," he said, "at no time was any management person told that he had to cut a specific cost. Instead, we concentrated on making them concerned with cost, and they in turn worked out the problems on their own initiative."

Ansul's choice of the participative method of making its employees cost conscious was a natural outgrowth of its management philosophy, which is to involve people in the company at all levels.

"We saw the problem of costs as a problem of people's attitudes more than as a problem of dollars. We felt that if we could motivate our people to be cost conscious, the costs would be cut," said Mr. Hood. ‡

On the Job —notes from the field

Single Duct High Velocity System Conditions Hospital

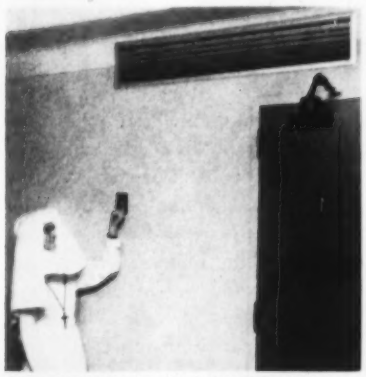
. . . three zones serve existing structure

A SINGLE DUCT high velocity system completely air conditions the five-story maternity building of St. Joseph's hospital, Houston, Texas. It was chosen because of economy and because the building had an existing heating system with radiators, according to C. H. Jochen, Bernard Johnson & Associates.

The installation marks the first use of a high velocity single duct system with high velocity air distribution outlets in Houston. The small ducts used in this system were threaded through the beams, columns, and joists of the existing structure. Trunk ducts are 26 in. in diameter, and feeder ducts average only 10 in.

The primary air conditioning engineering problem for this project was using a recirculating air system in a hospital where objectionable odors are created. The odor problem was solved by activated carbon air filters in series with glass fiber blanket filters and electrostatic filters.

Three central builtup air handling units in the basement, with capacities of 14,350 cfm, 25,875 cfm, and 17,500 cfm, supply conditioned air to separate zones. The central units plus four central conventional air handling units receive chilled water from two 100 ton packaged units using plant steam. The water chillers, chilled water pumps, and condenser water pumps are also in one basement. An induced draft cooling tower is on the laundry roof.



INDIVIDUAL ROOM CONTROLS permit nurse or patients to adjust or stop air conditioning as desired

Air conditioning in each four-bed, two-bed, and private room is controlled individually.

During installation, the maternity building continued to operate at better than one-half capacity.

All maintenance work may be performed in a central area in the basement. This not only takes less time than going to the rooms but also avoids disturbing patients. ✣

Plastic Greenhouses Cut Heating, Building Costs

. . . and improve crop yields

GREENHOUSES made of plastic film on simple wood frames in tests at the University of Kentucky and in commercial use on Long Island, N. Y., show construction savings of 83 to 95 percent and fuel savings up to 50 percent, according to the Bakelite Co.

At the university's agricultural experiment station farm at Lexington, an 18 × 84 ft greenhouse helped to grow good crops of seven different vegetables and 10 varieties of flowers. Tomatoes planted a year ago this spring yielded about ½ lb per plant more than those planted in a conventional greenhouse. Several commercial crops have been harvested during each of eight years here.

This house had twin sheaths of polyethylene covering the inside and outside of the wood framework. The outer layer was 0.002 in. thick and the inner layer 0.0015 in. thick. Materials cost $200, of which $50 was for plastic film and $150 for framework, doors, and laths of low cost rough lumber. Estimated cost of materials for a conventional structure of the same size: $4000.

The double layer of film, with its heat insulating dead air space in between, lowered heating cost to about one-half that for a conventional house of the same size. Lower heat loss at night and greater moisture retention aided in the growth of plants.

PLASTIC GREENHOUSE, with two layers of polyethylene plastic film covering inside and outside of wood frame, is insulated by dead air space between

Although the double layer of plastic film transmits only about 90 percent of the sunlight that will go through glass, the heat gain from the sun is not so great under plastic. Polyethylene resists rain, snow, hail, sleet, and even the acids and alkalies in the soil or in fungicides. Also, it stays flexible and durable from −90 to +190 F, but is damaged by harsh summer sunlight.

A smaller plastic greenhouse for Mill Road Greenhouses, Wantagh, Long Island, N. Y., amounted to about $500 for labor and materials, compared to $3000 for a conventional house of the same size. This new plastic house, of 2 × 4 in. and smaller wood members and 3000 sq ft of 0.002 in. polyethylene film simply tacked to it with wood lath, took about 150 manhours to construct.

It serves as an isolation house for growing cultured, disease free carnations year 'round. Replacing the clear plastic film each year, because of damage by summer sun, is estimated to cost between $100 and $150 for materials and labor. ✣

Sam Lewis' Page

Type of Heating-Cooling System Depends on Building Type, Height

The question of whether to specify a steam, hot water, or warm air heating system demands consideration of several factors. Among them are the height of the building; the orientation of the building and the measure of sun gain, especially with regard to the cooling load; and whether the cooling and heating effects are to be distributed by the same or separate components.

IF I AM TO DESIGN a steam heating plant for a very large or very tall building, I advocate steam supply with a vacuum return rather than water as the heat carrier. The weight of a column of water as in a 30-story building becomes impressively great while the steam and condensate do not care.

I might advocate a warm air heating system for a small low building. There are considerations that must be taken into account with this type of system, however, because when refrigerated air is substituted for warm air during hot weather, the balancing of the heat transfer distribution from one room to another, often is delicate, so that an expert, with instruments, must readjust the dampers. This readjustment must be made whenever the change from heating to cooling is required.

Another type of heating system is one that has heaters along the outer walls at the floor level, served by a mechanically circulated liquid whose temperature may be varied widely. Cooling for hot weather with this type of system may be administered by mechanical introduction of filtered and refrigerated air. The air in winter, of course, will be introduced into each room at a temperature close to the temperature desired at knee level in the room. Steam at a variable, subatmospheric pressure, may also be used to warm the heaters along the wall rather than a liquid approximately the steam temperature.

After many miles of experience with radiant hot water heating pipes in the ceilings, floors, or walls, I find that while the results are interesting, they do present problems in the design. There is a definite satisfaction to the average human if the air that circulates across his body in winter adds a little heat. And he worries about catching cold if he feels that the air is extracting heat from his body.

In our experience, when we have used the same pipes to transport warm water in winter and cool water in summer, to the same heat transfer surfaces, we have had little complaint about the time required for changeover at each seasonal period.

We do need a heating-cooling system, however, that can adjust reasonably with reference to amount of solar heat received at varying hours. We hear of people on the shady side of an office building who may feel cool in the morning while the air conditioning plant is trying to counterbalance the eastern solar heat. Then later, we hear of the eastern people who may be too cool in the afternoon when old Sol tries to peer in through the west windows. A steer in the pasture can turn his back to the cold wind and his thick hide protects him. He doesn't have to face the cold wind. The human, however, who is confined all day to a pleasant, sun lighted office in a tall building usually has no thick hide and cannot revolve his back or his desk to follow either the sun or the shade around the building.

I receive hoots of disdain from architect friends when I exclaim, with pleasure, at the modern building — whether for living quarters or for working quarters — that has an encouraging percentage of thick and well insulated walls. The zenith of the popularity of guinea pig type glass walls, I suggest, is passing. Give me some shade, some shelter, and some privacy. ‡

SAMUEL R. LEWIS, consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors, comments informally each month on practical heating, piping and air conditioning problems.

Names and Addresses of National Engineering Societies, Associations, etc.

Acoustical Society of America, 57 E. 55th St., New York 22, N. Y.

Air Conditioning Blower Manufacturers Association, 2300 Payne Ave., Cleveland 14, Ohio

Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N. W., Washington 6, D. C.

Air-Conditioning and Refrigeration Wholesalers, 2607 N. High St., Columbus, Ohio

Air Distribution Institute, 2130 Keith Bldg., Cleveland 15, Ohio

Air Filter Institute, 3 Center Park, Rochester 3, N. Y.

Air Moving and Conditioning Association, Inc. 2159 Guardian Bldg., Detroit 26, Mich.

Air Pollution Control Association, 1400 Fifth Ave., Mellon Institute Bldg., Pittsburgh 13, Pa.

Aluminum Association, 420 Lexington Ave., New York 17, N. Y.

American Foundrymen's Society, Golf & Wolf Rds., Des Plaines, Ill.

American Gas Association, 420 Lexington Ave., New York 17, N. Y.

American Industrial Hygiene Association, 14125 Prevost, Detroit 27, Mich.

American Institute of Architects, 1741 New York Ave., Washington, D. C.

American Institute of Electrical Engineers, 33 W. 39th St., New York 18, N. Y.

American Institute of Wholesale Plumbing & Heating Supply Associations, Inc., 402 Albee Bldg., Washington, D. C.

American Iron and Steel Institute, 350 Fifth Ave., New York 1, N. Y.

American Society for Engineering Education, 1201 W. California, Urbana, Ill.

American Society of Agricultural Engineers, 420 Main St., St. Joseph, Mich.

American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

American Society of Heating and Air-Conditioning Engineers, Inc., 62 Worth St., New York 13, N. Y.

American Society of Heating and Air-Conditioning Engineers Research Laboratory, 7218 Euclid Ave., Cleveland 3, Ohio

American Society of Mechanical Engineers, The, 29 W. 39th St., New York 18, N. Y.

American Society of Refrigerating Engineers, 234 Fifth Ave., New York 1, N. Y.

American Standards Association, 70 E. 45th St., New York, N. Y.

American Welding Society, 33 W. 39th St., New York 18, N. Y.

Anthracite Institute, 237 Old River Rd., Wilkes-Barre, Pa.

Better Heating-Cooling Council, 250 Park Ave., New York, N.Y.

Bituminous Coal Institute, Southern Bldg., Washington 5, D. C.

Bituminous Coal Research, Inc., 121 Meyran Ave. at Forbes St., Pittsburgh 13, Pa.

Building Research Advisory Board, National Academy of Sciences-National Research Council, 2101 Constitution Ave., N.W., Washington 25, D. C.

Building Research Institute, National Academy of Sciences, National Research Council, 2101 Constitution Ave., Washington 25, D. C.

Code for Pressure Piping, ASA Sectional Committee B 31, L. W. Benoit, Secretary, 420 Lexington Ave., Room 647, New York 17, N. Y.

Committee on Steel Pipe Research, American Iron and Steel Institute, 350 Fifth Ave., New York 1, N. Y.

Compressed Air & Gas Institute, 1400 Terminal Tower, Cleveland 13, Ohio

Convector Manufacturers Association, 2159 Guardian Bldg., Detroit 26, Mich.

Tear out along this line

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Cooling Tower Institute, 446 Emerson St., Palo Alto, Calif.

Copper and Brass Research Association, 120 Lexington Ave., New York 17, N. Y.

Edison Electric Institute, 420 Lexington Ave., New York 17, N. Y.

Environmental Equipment Institute, 30 Church St., New York 7, N. Y.

Fluid Controls Institute, Inc., P. O. Box 191, Decatur, Ill.

Fuel Oil & Water Heater Manufacturer's Association, P.O. Box 151, East Greenwich, R.I.

Gas Appliance Manufacturer's Association, 60 E. 42nd St., New York 17, N. Y.

Heat Exchange Institute, 122 E. 42nd St., New York 17, N. Y.

Heating and Cooling Coil Manufacturers Association, 2159 Guardian Bldg., Detroit 26, Mich.

Heating, Piping and Air Conditioning Contractors National Association, (The Mechanical Contractors Association of America) Suite 1843, 30 Rockefeller Plaza, New York 20, N. Y.

Humidifier Association, 2300 Payne Ave., Cleveland 14, Ohio

Insulation Distributor-Contractors National Association, Inc., 3120 Dent Place, N.W., Washington 7, D.C.

Industrial Mineral Fiber Institute, Inc., 441 Lexington Ave., New York 17, N. Y.

Industrial Unit Heater Association, 2159 Guardian Bldg., Detroit 26, Mich.

Institute of Boiler and Radiator Manufacturers, 603 Fifth Ave., Room 408, New York 20, N. Y.

Institution of Heating and Ventilating Engineers, 49 Cadogan Sq., London, S. W. 1, England

Instrument Society of America, Granite Bldg., 313 Sixth Ave., Pittsburgh 22, Pa.

Insulation Board Institute, 111 W. Washington St., Chicago 2, Ill.

Magnesia Insulation Manufacturers Association, 1317 F St., N. W., Washington 4, D. C.

Manufacturers' Standardization Society of the Valve & Fittings Industry, 420 Lexington Ave., New York 17, N. Y.

National Association of Building Owners and Managers, 134 S. LaSalle St., Chicago 3, Ill.

National Association of Corrosion Engineers, 1061 M & M Bldg., Houston 2, Texas

National Association of Fan Manufacturers, Inc., 2159 Guardian Bldg., Detroit 26, Mich.

National Association of Power Engineers, Inc., 176 W. Adams St., Chicago, Ill.

National Association of Practical Refrigerating Engineers, 435 N. Waller Ave., Chicago 44, Ill.

National Board of Fire Underwriters, 85 John St., New York 38, N. Y.

National Bureau of Standards, Washington 25, D .C.

National Certified Pipe Welding Bureau, Suite 1843, 30 Rockefeller Plaza, New York 20, N. Y.

National Coal Association, Southern Bldg., 15th and H Sts., N. W., Washington 5, D. C.

National District Heating Association, 827 N. Euclid Ave., Pittsburgh 6, Pa.

National Electrical Manufacturers Association, 155 E. 44th St., New York 17, N. Y.

National Fire Protection Association, 60 Batterymarch St., Boston, Mass.

National Heating & Airconditioning Wholesalers, Inc., 1200 W. 5th Ave., Columbus 12, Ohio

National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill.

National-Warm Air Heating and Air Conditioning Association, 640 Engineers Bldg., Cleveland 14, Ohio

Oil-Heat Institute of America, 500 Fifth Ave., New York 36, N. Y.

Pipe Fabrication Institute, Room 759, One Gateway Center, Pittsburgh 22, Pa.

Power Fan Manufacturers' Association, 2159 Guardian Bldg., Detroit 26, Mich.

Producers' Council, Inc., 2029 K St., N.W., Washington 6, D. C.

Refrigeration and Air Conditioning Contractors National Association, 10660 Carnegie Ave., Cleveland 6, Ohio

Refrigeration Industry Safety Advisory Committee, 1346 Connecticut Ave., N. W., Washington 6, D. C.

Refrigeration Service Engineers Society, 433 N. Waller Ave., Chicago 44, Ill.

Refrigeration Trade Association of America, 3531 14th St., N. W., Washington 10, D. C.

Sheet Metal Contractors National Association, 170 Division St., Elgin, Ill.

Society of Automotive Engineers, 29 W. 39th St., New York, N. Y.

Society of the Plastics Industry, Inc., 250 Park Ave., New York 17, N. Y.

Steam Heating Equipment Manufacturers Association, 3738 N. Holton St., Milwaukee 12, Wis.

Steel Boiler Institute, Inc., 1308 Land Title Bldg., Philadelphia 10, Pa.

Stoker Manufacturers Association, 307 N. Michigan Ave., Chicago 1, Ill.

Tubular Exchanger Manufacturers Association, Inc., 53 Park Place, New York, N. Y.

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Small-Pipe Perimeter Heating in a Residence†

By D. R. Bahnfleth*, Urbana, Ill., H. T. Gilkey**, Cleveland, Ohio, and C. F. Chen††, Providence, R. I.

SUMMARY—Performance data are given for a warm-air perimeter heating system installed in Warm Air Heating Research Residence No. 2 at the University of Illinois. The effect of heat addition to the basement on the room-air temperature conditions on the first story are discussed. It was found that an increase of 12 percent in total energy input was required when the basement was heated. Temperature drop in 4-in. diameter ducts was measured and compared to previously published temperature drop information. A comparison of the performance of the perimeter system and the high sidewall systems studied previously in the Residence is given.

INVESTIGATIONS of warm-air heating systems have been conducted in Warm Air Heating Research Residence No. 2 since 1947. These investigations have included studies of a high sidewall delivery system and a warm-air ceiling panel system[1], the introduction of outdoor air into the system and furnace-closet ventilation[2], and small-pipe perimeter systems.

The success of the warm-air perimeter system in homes with concrete slab floors led to the use of the perimeter concept for heating homes built over basements and crawl spaces. A preliminary study in Research Residence No. 2 during the latter part of the 1951-52 heating season resulted in the research program begun in the fall of 1952. This paper reports in part the results obtained during the 1952-53 and 1953-54 heating seasons.

The principal objectives were to determine:

1. The degree of uniformity of the room-air temperatures maintained by a perimeter heating system.
2. The effect of heat addition to the basement on both the room- and basement-air conditions and on the operating costs.
3. The operating characteristics of a small-pipe duct system and furnace; and
4. To compare the performance of a perimeter system with that of a high sidewall convection system.

Description of Residence

The Residence, shown in Fig. 1, is a one-story frame structure with full basement. Walls are insulated with 3-5/8 in. mineral wool batt type insulation with vapor barrier attached. Ceiling is insulated with 5 in. of mineral wool. The calculated coefficient of heat transmission, U, for the walls and ceiling is 0.07 Btu per (hr) (sq ft) (F deg). Windows, with the exception of the double glazed fixed window in the living room, are

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*Research Associate in Mechanical Engineering, University of Illinois. Junior Member of ASHAE.

**Technical Secretary, *National Warm Air Heating & Air Conditioning Association*. Formerly Research Associate in Mechanical Engineering, University of Illinois. Junior Member of ASHAE.

††Research Assistant, Department of Engineering, Brown University. Formerly Research Assistant in Mechanical Engineering, University of Illinois. Junior Member of ASHAE.

[1]Exponent numerals refer to References.

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of the horizontal sliding type with storm sash attached to the window sash. Doors are of conventional wood and glass construction and are equipped with storm doors. The windows are weather-stripped. Usable floor area is about 1000 sq ft. Room dimensions and arrangement are shown in Fig. 2.

Fig. 1— Warm Air Heating Research Residence No. 2

The heated space consisted of the first story rooms as well as the entire basement. The design heat loss[1], for −10 F outdoors and 70 F indoors, was 52,300 Btuh. This total consisted of 21,300 Btuh for the basement and 31,000 Btuh for the first story.

Furnace and Duct Systems

The duct systems were designed in accordance with *Manual No. 10* of the *National Warm Air Heating and Air Conditioning Association*. The 4-in. diameter ducts were connected directly to the bonnet of a gas-fired furnace with rated input of 70,000 Btuh. The supply outlets, located at the outside wall under the windows, were all 2¼ × 14-in. floor diffusers. Each supply duct was equipped with a volume damper with which the system was balanced. The diffuser valves were fully opened at all times.

The two duct systems used are shown in Fig. 3. In Series F-11, 8 outlets were used to supply warm air to the first-story rooms. In Series F-21 and F-24, 6 outlets were used on the first story and 3 outlets were used in the basement. The three 2¼ × 14-in. floor diffusers used to supply heat to the basement were located near the underside of the floor joists and used as ceiling diffusers.

One centrally located return-air grill was located on the first story. It consisted of a 24 × 6-in. baseboard grill and a 24 × 8-in. floor grill combination and was used for all studies. The total free area of the grill combination was 289 sq in. The 24 × 12-in. opening in the floor was reduced to 12 × 12 in. with a reducing elbow, and the return duct was of constant size from the elbow to the return plenum.

A 9-in. diameter duct was used for the basement return in the studies conducted with heat added to the basement. The intake to the basement return was located approximately 1 ft below the floor joists during most studies. A short test was made with the basement return in a horizontal position so that the intake was at the basement floor level. Each return-air duct was equipped with a volume damper.

Table 1—Fuel-Input Rates, Air-Flow Rates, and Heat-Input Rates to the First Story and Basement

Series	Fuel-Input Rate, cu ft per hr	Total Air-Flow Rate, cfm[a]	Heat-Input Rate, Btuh	
			Basement	First Story
F-11	46.0[b]	340	0	31,000
F-21	51.4[c]	385	10,000[d]	31,000
F-24	65.5[c]	490	21,300[e]	31,000

[a]Computed air-flow rate for 100 F temperature rise through furnace.
[b]Input equals first-story loss divided by product of assumed bonnet and duct transmission efficiencies, 80 and 85 percent, respectively, for natural gas at 1000 Btu per cu ft.
[c]Input determined by same method as above, with an assumed duct transmission efficiency of 100 percent.
[d]Equivalent to the calculated above-ground heat loss.
[e]Equivalent to the total calculated heat loss.

Instrumentation

Approximately 210 copper-constantan thermocouples were provided for temperature measurement. Room-air temperatures were measured at 4 levels at the locations shown in Fig. 2. Instrumentation was also provided to measure indoor relative humidity, electrical inputs to the lights and appliances and to the blower, the fuel input rate, the time of burner and blower operation, the air-flow

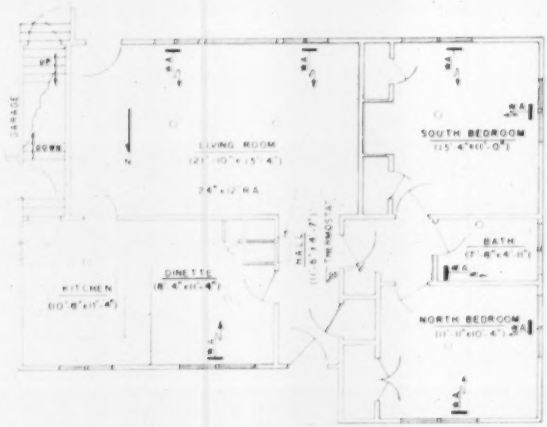


Fig. 2—Floor plan of residence. All warm air outlets are 2¼-in. x 14-in. floor diffusers. R.A. shows return air opening; W.A. shows warm air openings; circles show locations of thermocouple standards

rates in the duct systems, and the pressure losses of the duct systems.

Experimental Procedure

Air-flow rates through the furnace, fuel input rates, and heat input rates to the basement and first story are shown for each study in Table 1. The furnace was adjusted for continuous air circulation[5] for each study. The fuel input rate for each study was determined from the calculated heat loss. The desired input was obtained by changing the burner orifice and by adjusting the burner manifold pressure at the pressure regulator of the furnace. The air-flow rate through the furnace was set to give an air temperature rise in the furnace of 100 deg with the

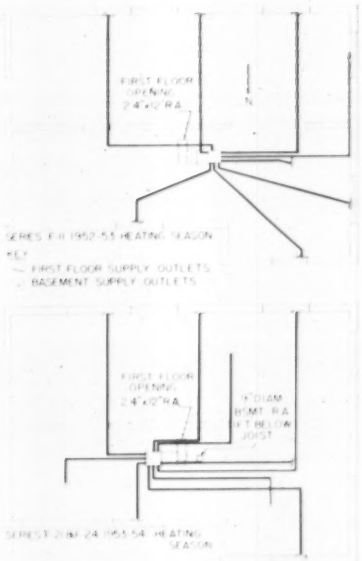

FIRST FLOOR OPENING 24"x12" R.A.
SERIES F-11 1952-53 HEATING SEASON
FLOOR
FIRST FLOOR SUPPLY OUTLETS
BASEMENT SUPPLY OUTLETS
FIRST FLOOR OPENING 24"x12" R.A.
8" DIAM BSMT. R.A. 6 FT. BELOW JOIST
SERIES F-24 1953-54 HEATING SEASON

Fig. 3—Basement plan and duct layouts

burner and blower operating continuously.

The procedure used to obtain the desired heat inputs to the basement was as follows:

1. Fuel input rate was set for Series F-21 based upon the first-story heat loss (31,000 Btuh), and the above-ground basement heat loss (10,000 Btuh). The total air-flow rates to the first story and basement were set near values calculated for a 100 deg rise with a bonnet static pressure of approximately 0.190 in. water gage.

2. Individual air-flow rates in the first-story runs were adjusted to obtain satisfactory room-to-room temperature balance while maintaining the same total air-flow rate to the first story.

3. Temperature rise through the furnace was then measured and the basement air-flow rate was adjusted until a rise of 100 deg was obtained. During these adjustments the bonnet static pressure was maintained constant.

4. In succeeding tests the fuel input rate was adjusted to the desired value. Then only the blower speed and basement dampers were adjusted until a rise of 100 deg was obtained with a bonnet static pressure of 0.190 in. water gage.

5. Air-flow rates in the returns were adjusted by means of dampers so that the return-air flow from each zone equalled that which was delivered to the zone.

The thermostat, located at the 30-in. level in the entrance hall, was set to maintain a temperature of 72 F. The thermostat differential was adjusted to cause burner on-periods of 3 to 4 min. when the outdoor temperature was between 20 and 30 F.

The Residence was occupied by a family of two adults during Series F-11. During Series F-21 and F-24 the Residence was furnished but unoccupied.

Comfort was evaluated on the basis of the air and surface temperatures in the Residence. These temperatures were recorded at 6:00 a.m. in order to minimize the effects of occupancy and solar radiation. The results are all based on these 6:00 a.m. readings unless otherwise noted.

Results

Uniformity of Room-Air Temperatures: The cyclical variation of room-air temperatures at the 30-in. level was small, less than 1 deg, with all three series. The response was considered satisfactory since no lag or overrun was experienced during periods of rapidly changing outdoor temperature.

The room-to-room temperature balance at the sitting level was satisfactory for each of the systems studied. In general, the temperature difference between rooms was less than 2 deg. The maximum difference in temperature between rooms for each of the studies conducted was 2.4, 1.8, and 2.3 deg, for Series F-11, F-21, and F-24, respectively. This maximum unbalance occurred during days when high wind velocities and low outdoor temperatures were experienced. The lowest room-air temperatures during Series F-21 and F-24 occurred

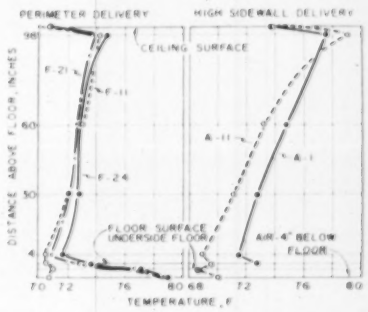


Fig. 4—Room-air temperature gradients in living room: with outdoor temperatures from 31-37 F; at night without sun; with continuous blower operation; wind velocity of 3 to 7 mph, southwest

in the bedrooms. The capacities of the single runs to each of these rooms were less than the design heat losses, but the installation was made in this manner to determine if heat addition to the basement would have any material effect on the balance. Heat addition to the basement did not improve the balance in the first-story rooms.

The room-air temperature gradients in the living room are shown in Fig. 4 for both the perimeter systems and the high sidewall systems studied previously[1]. The gradients in the left-hand portion of the figure are for the 3 conditions of heat addition to the basement with the perimeter system; the gradients on the right are for 2 conditions of heat addition to the basement with the high sidewall system. In Series A-1 the basement was heated; in Series A-11 the basement was unheated. These can be compared with Series F-24 and F-11, respectively.

Several observations which apply to conditions in all rooms can be made. The addition of heat to the basement did not materially improve the gradients experienced with the

perimeter system. Since the gradients with the basement unheated, Series F-11, were very small, only small improvements due to heating the basement could be anticipated. The addition of heat to the basement with the high sidewall system did improve the first story gradients as is shown in Fig. 4. The improvement was due to the panel heating obtained from the warm floor. The gradients of the perimeter system were more satisfactory than those experienced with the high sidewall system.

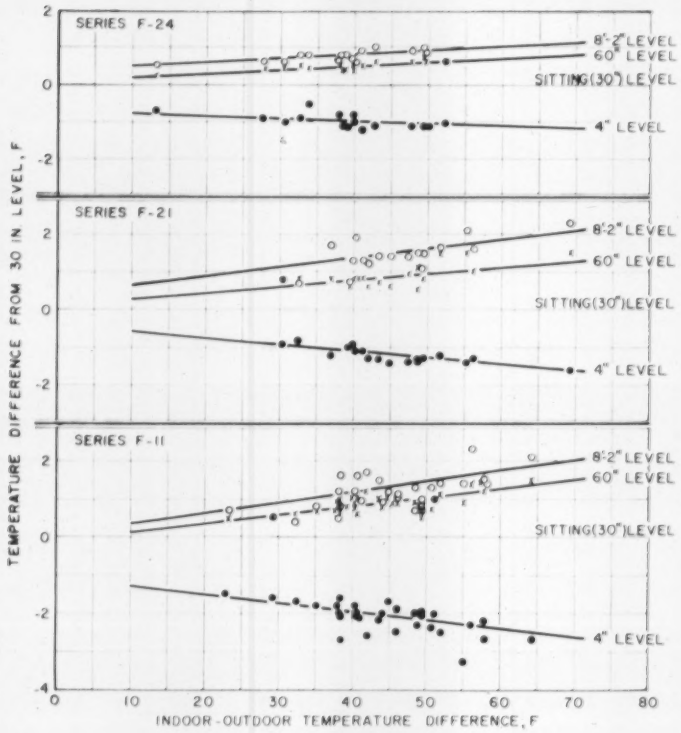
The effect of outdoor temperature on the average room-air temperature differentials for the perimeter systems is shown in Fig. 5. The tabulation at the bottom of Fig. 5 summarizes the average differentials for the 3 perimeter systems and the two high sidewall systems. Even though the effect of heat addition was slight in the case of the perimeter systems, significant improvement was experienced in the temperature differences from the floor to the sitting level. As will be shown later this can be attributed to the higher floor-surface temperatures maintained when heat was added at the basement.

The temperature differentials in the living zone (floor level to breathing level) which were experienced with the perimeter system were more satisfactory than those experienced with the high sidewall system. From the tabulation in Fig. 5, it can be seen that the temperature difference from the floor to the breathing level with Series F-21 was 2.0 deg and that for Series A-1, it was 4.7 deg when the outdoor temperature was 0 F (indoor-outdoor temperature difference = 70 deg), and the basement was heated. When the basement was unheated, the temperature differences in the living zone were 4.1 and 6.9 deg in Series F-11 and A-11, respectively. The improvement in the average living zone differentials caused by heating the basement was approximately the same for both systems investigated.

The temperature differentials from the floor level to the ceiling level with the perimeter systems were smaller than those experienced with the high sidewall systems. As is shown in the table these differentials were 2.3 and 12.4 deg for Series F-24 and A-1, respectively, at an outdoor temperature of 0 F. When the basement was unheated, these differentials were 4.6 and 16.9 deg, in Series F-11 and A-11, respectively. The large floor to ceiling differentials observed for the high sidewall systems (A-1, A-11) do not indicate an uncomfortable condition since the major portion of this temperature difference occurred between the breathing and ceiling levels. They do indicate, however, that the heat loss of the Residence may be greater when heating with the high sidewall system.

A comparison of the floor to ceiling temperature differentials and the gradients (Fig. 5) experienced with the perimeter and high sidewall systems, indicates that the average room-air temperature was lower with the perimeter systems. These lower average room-air temperatures reduced the heat loss of the Residence, thus resulting in a lower operating cost. Since the reduction in room-air temperature was greatest at the ceiling level, amounting to approximately 10 deg, the ceiling losses were appreciably reduced.

Special studies were conducted during Series F-21 and F-24 to determine the uniformity of room-air temperature at the floor- and sitting-levels in the living room. Air temperatures at the 2 levels were measured at 76 locations by portable thermocouples.



TEMPERATURE DIFFERENTIALS, F	INDOOR-OUTDOOR TEMPERATURE DIFFERENCE									
	35 F					70 F				
	F-11	F-21	F-24	A-11	A-1	F-11	F-21	F-24	A-11	A-1
3"FI-30"FI	1.8	1.0	0.9	1.8	0.9	2.6	1.6	1.2	2.6	1.7
3"FI-60"FI	2.5	1.7	1.3	3.8	2.3	4.1	2.9	2.0	6.9	4.7
3"FI-3"CLG	2.9	2.3	1.7	8.1	5.4	4.6	3.7	2.3	16.9	12.4

Fig. 5—Average room-air temperature differentials

Since the results of all of these special studies were similar, only those obtained on March 4, 1954 are presented in Fig. 6.

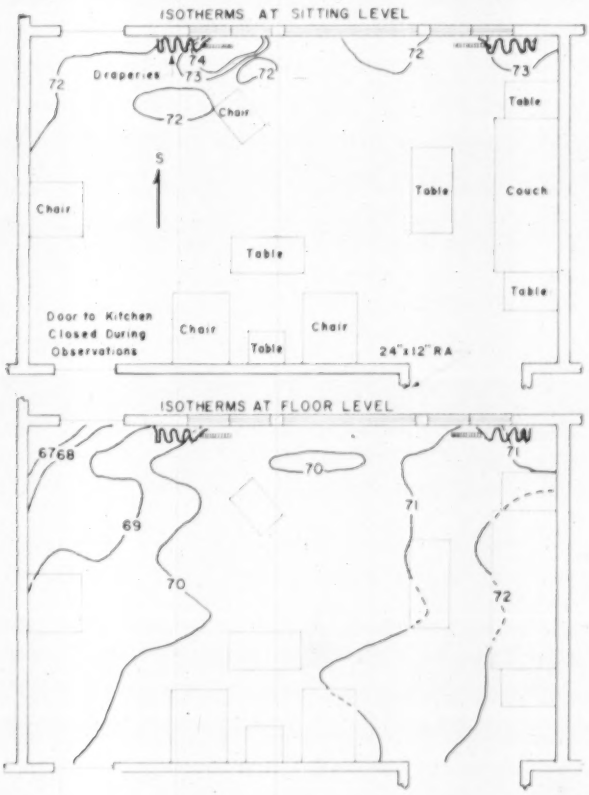


Fig. 6—Isothermal contours in living room: with outdoor temperature at 14 F; at night without sun; continuous blower operation; wind velocity at 4 mph, northwest

The room-air isotherms at the sitting level ranged from 71.3 F near the picture window to 74.5 F above the floor diffusers, and most sitting-level air temperatures were between 72 and 73 F.

The isotherms at the floor level ranged from 67.0 F at the southeast corner to 72.1 F at the northwest corner. About one-fourth of the total area at the floor level was below 70 F. This cool area was caused by the infiltration from the outside door and the cold down drafts from the door and east wall which is partially exposed to the attic. The pattern of the isotherms at the floor level indicates that the warm air from the floor diffuser had little influence on the down drafts at the exposed corner.

Floor-Surface Temperatures: The floor-surface temperature at any point depended upon its location with respect to the furnace and exposed walls. In the immediate vicinity of the furnace, the floor-surface temperatures were satisfactory when the basement was unheated and tended to increase with decreasing outdoor temperatures. Fig. 7 shows that the addition of heat to the basement served only to increase these temperatures further, thus increasing the heat regains to this area. The middle area of Fig. 7 was influenced by the heat losses from the ducts but was not greatly affected by the exposed walls. The addition of heat to the basement increased these floor-surface temperatures, but little effect of outdoor temperature was apparent. Since this is both the largest area considered and that most used by the occupants, the addition of heat caused a significant improvement.

The floor-surface temperatures of the edge area, near the perimeter of the Residence, were primarily affected by the exposed walls. The lower curves of Fig. 7 show that the floor-surface temperature in the exposed corner of the south bedroom was not increased appreciably during Series F-21, when the amount of heat added to the basement was equal to its above-ground heat losses. A small increase in temperature was observed when the basement was fully heated in Series F-24. The improvement at the perimeter in Series F-24 was attributed to the higher register-air velocities in the basement with the higher heat inputs. Consequently, the air distribution in the basement was improved and some of the warm air from the outlet reached the exposed corner.

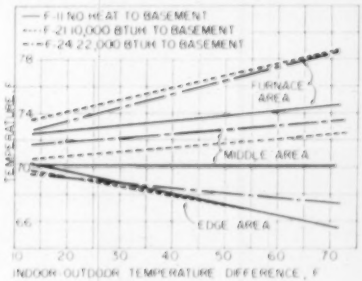


Fig. 7—Effect of outdoor air temperature and heat input to basement on selected floor surface temperatures

In view of the floor-surface temperatures experienced during these studies, the most desirable location for basement outlets would appear to be in the vicinity of the exposed corners of the Residence. Because of the duct and bonnet losses, the floor-surface temperatures in the central area of the house will be satisfactory without the addition of heat to the basement in this area.

Basement-Air Temperature Variation: The air-temperature gradients in the southwest section of the basement are shown in the upper portion of Fig. 8. Although the gradients were not improved by heat addition to the basement, the air temperatures at each level were improved by the addition of heat.

The effect of outdoor temperature on the air temperatures at the sitting level in the basement is shown in Fig. 8. A comparison of Series F-11 and F-24 shows that the air temperature at the 30-in. level in the basement increased from 63.2 F to 69.2 F at an outdoor temperature of 0 F when the basement was fully heated. Locating the basement return at the floor level caused a further improvement of about 1 deg in the air temperatures at the floor and sitting levels.

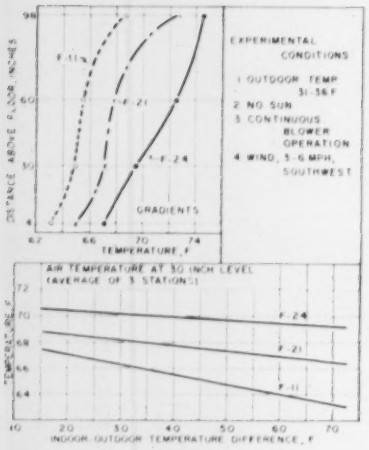


Fig. 8—Air-temperature gradients and air temperatures in basement

Pressure Losses: The observed pressure losses for the study in which no heat was added to the basement (Series F-11) were 0.107 in. water gage on the warm-air side and 0.016 in. water gage on the return side at an air-flow rate of 340 cfm. As was mentioned previously, the pressure losses on the warm-air side were adjusted to 0.190 in. water gage during Series F-21 and F-24 in which the flow rates were 385 and 490 cfm, respectively. The return losses were 0.015 and 0.042 in. water gage for Series F-21 and F-24, respectively.

Temperature Drop in 4-in. Diameter Ducts: Studies were made during the 1952-53 heating season to determine the temperature drop in 4-in. diameter ducts. The duct system was that used for Series F-11, and the individual runs were of various lengths and included different numbers of 4-in adjustable elbows. The air-flow rate in the ducts, and the temperature of the entering air were varied to determine the effect of velocity and entering air temperature on the temperature drop. The results of these studies have been compared to temperature drop information obtained by extrapolation from previously published data[6].

Fig. 9 summarizes the results of these studies for duct-air velocities of 600 fpm and for two conditions of heat addition to the basement. The upper curve shows the average temperature drop when 10,000 Btuh was added to the basement to offset the above-ground heat losses. The middle curve shows the average temperature drop for the unheated basement condition, and the lower curve is that obtained from the results of previous work. Good correlation was obtained, especially for duct lengths which would commonly be found in small-duct heating systems. The addition of heat to the basement caused a slight decrease in the temperature drop.

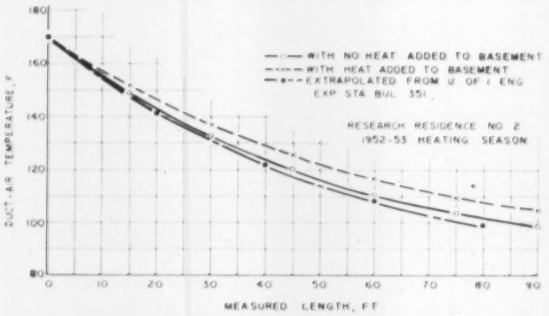

WITH NO HEAT ADDED TO BASEMENT
WITH HEAT ADDED TO BASEMENT
EXTRAPOLATED FROM U OF I ENG EXP STA BUL 351
RESEARCH RESIDENCE NO 2
1952-53 HEATING SEASON
DUCT-AIR TEMPERATURE, F
MEASURED LENGTH, FT

Fig. 9—Average temperature drop in 4-in. diameter ducts for velocity of 600 fpm

Overall duct losses were measured and were found to be approximately 15 percent of the input to the furnace. Even though the transmission efficiencies were not affected by the addition of heat to the basement, the magnitude of the duct losses was smaller when the basement was heated. This occurred because no allowance for transmission loss was made when heat was added to the basement. Thus, for a given register delivery and air temperature entering the duct, the air-flow rate will be less if no transmission loss is assumed to occur.

Fuel Consumption: During 2 of the 3 studies reported, the Residence was not occupied. The energy lost from the structure during any day equalled that supplied by the furnace plus the small amount required to operate the instruments and blower, and to maintain the water heater control temperature. When the Residence was occupied, the increased use of the water heater, the lights, and the kitchen range supplied more of the energy required and resulted in lower daily fuel consumption. A realistic comparison of the cost of heating can be obtained only by considering total energy input during each of the studies.

Table 2—Effect of Heat Addition to Basement on Total Energy Input to the Residence for Three Perimeter and Two High Sidewall Systems

Outdoor-Outdoor Temperature Difference = 80 F

Series	Type of System	Heat Input to Basement, Btuh	Total Energy Input to Residence	
			Btu per day	Increase Due to Heating Basement, percent
F-11	Perimeter	0	1,070,000	—
F-21	Perimeter	10,000	1,200,000	12.1
F-24	Perimeter	21,500	1,200,000	12.1
A-11	High Sidewall	0	1,250,000	—
A-1	High Sidewall	26,285	1,380,000	10.4

In Table 2 the total energy input to the Residence in Btu per day is

shown for the local design temperature, −10 F. The data were taken from curves of total energy input plotted as a function of indoor-outdoor temperature difference for each of the studies conducted. Values from these curves represent averages for the range of weather conditions experienced, and it was assumed that the percentage of the total input used to offset the heat loss was constant regardless of the source of the energy.

Adding heat to the basement caused an increase of 12 percent in fuel consumption whether heat was added to the basement at the rate of 10,000 or 21,000 Btuh. In each case the additional fuel consumption was less than would be predicted from the calculated heat loss of the basement. This can be attributed to the increased panel gains to the first story as the heat addition to the basement was increased. Although the panel gains could not be measured, they were evidenced by a decrease in the average length of burner cycle as the rate of heat addition to the basement was increased.

It has previously been shown[1] for the high sidewall system that, for the same condition of occupancy, the furnace consumed approximately 10 percent more fuel when the basement was heated. As is shown in Table 2 this percentage increase was also experienced in the total energy input to the Residence. Under similar conditions of heat addition to the basement the total energy consumption was less for the perimeter system.

CONCLUSIONS

Cyclical variation in room-air temperature was small with the three perimeter systems studied. The room-to-room temperature balance was not affected by heat addition to the basement. This was especially noticeable in the bedrooms where the duct capacities were less than the calculated heat losses of the rooms.

Only small improvements in the room-air temperature gradients and differentials were observed when heat was added to the basement. Since the differentials experienced with most perimeter systems are good, only small improvements were anticipated.

The floor-surface temperatures were satisfactory without heat addition to the basement except near the exterior walls. There was, however, an increase in the floor-surface temperatures in the region between the perimeter and the area directly affected by the furnace bonnet when heat was added to the basement. The floor-surface temperatures at the perimeter were improved very little by adding heat to the basement. It appears that the basement outlets should be located near the exposed corners of the Residence.

The total energy input increased 12 percent when the basement was heated. This percentage increase is much less than that which would be predicted from the calculated heat loss of the basement. Previous investigations of a high sidewall system indicated a 10 percent increase in energy input was needed when the basement was heated.

In general, the temperature differentials and gradients with the perimeter systems were better than those experienced with the high sidewall system under similar conditions of operation. The living zone differentials differed by only 1 to 3 deg, depending upon the outdoor temperature, but a greater difference was observed in the floor-to-ceiling temperature differentials. Even though this is not important from the standpoint of comfort, it does indicate that a lower heat loss and consequently a lower operating cost could be anticipated for the perimeter system. A comparison of the total energy input for the perimeter and high sidewall systems shows that for similar conditions the total energy consumption was less for the perimeter system.

Good agreement was found between measured temperature drop in 4-in. diameter ducts and temperature drop information published previously[6]. Some reduction in duct heat loss occurred when the basement was heated. In duct lengths which would normally be found in perimeter systems, this reduction was small.

Overall duct losses were found to be 15 percent of the input to the furnace. This loss is in good agreement with the assumed duct transmission efficiency of 85 percent commonly used.

Acknowledgments

It is expected that these results will ultimately comprise part of a bulletin of the Engineering Experiment Station. Acknowledgment is hereby made to the manufacturers who cooperated by furnishing materials and equipment used in this investigation.

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The President's Page

A Message to Former Junior Members

One of the basic objectives of the recent By-Law changes approved at the Cincinnati Annual Meeting was to bring the qualifications for membership grades into uniformity with the recommendations of the **Engineers' Council for Professional Development (ECPD).** The overall program of **ECPD** is to enlist the support of all professional engineering societies in adopting minimum qualifications for Fellow, Member, Associate Member, Affiliate and Student membership grades.

By the adoption of these new By-Law revisions by our Society, all former Junior Members were automatically transferred to Associate Member grade status at the close of our Annual Meeting in Cincinnati, January 26, 1956.

For the year 1956 there will be no change in membership dues for the former Junior Members who were transferred to Associate Members. However, when dues billings are issued for 1957, all of these new Associate Members, 30 years of age or over, will be billed for $25.00 annual dues. This dues arrangement is different from that for the former Junior Member in that $15.00 was the amount of annual dues until age 33 when he was automatically transferred to Affiliate grade with annual dues of $25.00, unless he applied for and was elected to Member grade.

Because of these changes in grade status and dues arrangement, I would like to urge that all former Junior Members, who have the qualifications, apply for transfer to Member grade as there are no longer any minimum age requirements, except that a person 30 years and younger is not likely to qualify because of the 10 year professional engineering experience requirement.

Do you know the requirements for Member grade? Are there advantages in achieving Member status? It is true that Associate Members 30 years of age or over are eligible to vote, but did you know that Associate Members are not permitted to hold elective office in the national Society? Here are the new qualifications for Member grade.

Any engineer or teacher of engineering, having ten (10) years or more of experience of a character satisfactory to the Council in the arts relating to the sciences of heating, ventilating, cooling or air conditioning, or the allied arts and sciences, of which four (4) years or more shall have been in responsible charge of important engineering work or in the teaching of courses in said arts and sciences, shall be eligible to become a Member. Architects, chemists, physicians, scientists, and other persons, deemed by the Council to be qualified by reason of special experience in the said arts and sciences, shall also be eligible to become Members.

Graduation from an engineering school with an engineering curriculum accredited by the **Engineers' Council for Professional Development,** or from a foreign engineering school maintaining similar standards, or from an engineering school of collegiate grade approved by the Council, shall be deemed equivalent to four (4) years of such experience; from other technical schools maintaining four (4) year courses, three (3) years; from a non-engineering college, two (2) years; and each successfully completed year in an engineering college shall be deemed equivalent to one (1) year of such experience.

An analysis of these qualifications leads to the rightful conclusion that Member status represents attainment of maturity in leadership and engineering. A Member is recognized as having the necessary qualifications for leadership and supervision. There are numerous benefits to be derived from Member status with respect to added prestige. If you can meet the qualifications for Member grade, I urge you to request an application for advancement and submit it to the Executive Secretary of the Society for consideration by the Committee on Admission and Advancement.

John W. James

President
American Society of Heating and Air-Conditioning Engineers

LABORATORY FOR SOLAR ENERGY STUDY AT MINNESOTA

By R. C. Jordan* and J. L. Threlkeld**, Minneapolis, Minn.

This paper is the result of research sponsored by the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, in cooperation with the Graduate School, University of Minnesota, and conducted through the Department of Mechanical Engineering, University of Minnesota, Minneapolis, Minn.

SUMMARY — Description of the special laboratory facilities constructed at the University of Minnesota to study solar engineering. The nature of the problems is outlined. Also contains a description of some of the projects now in progress and outlines some of those planned in the future.

SOLAR radiation is our single large source of inexhaustible energy. An accelerated interest in solar energy has developed in recent years and a number of symposia have been held in various parts of the world. Several institutions in the United States are now engaged in sizeable research projects on solar energy. One of these is at the University of Minnesota.

Of the many problems involved in the harnessing of solar energy, two of the more important ones are (1) the extent and availability of the energy supply, and (2) the design and performance of flat-plate collectors. To contribute further knowledge on these two topics has been the primary reason for establishing the solar engineering laboratory described here.

The availability of solar radiation outside the atmosphere is accurately known. But in passing through the atmosphere part of the radiation is scattered and part is absorbed by the constituents of the atmosphere. This depletion is substantial even during cloudless days, and with heavy cloudiness depletion of direct solar radiation may be almost complete.

Solar radiation received by a surface on the earth may consist of direct radiation from the sun and indirect or diffuse radiation from the sky vault and from objects around the irradiated surface, particularly the ground cover in front of the surface. In order to design a solar utilization device, detailed knowledge of rates of direct and diffuse radiation are necessary.

Important contributions have already been made toward accurately estimating cloudless day radiation at the earth's surface. Notable are Moon's paper[1] on direct radiation and Parmelee's paper[2] on diffuse radiation. Yet there is a general lack of information available to the engineer on quantitative estimates of solar radiation during cloudless days.

During days with cloudiness even less information is available. Besides needing information on rates of direct and diffuse radiation during varying degrees of cloudiness, the engineer must know the distribution or frequency of occurrence of clear and cloudy days and the possible sequences of these days to be expected.

Through an experimental program of direct and diffuse radiation measurements, and through detailed examination of U. S. Weather Bureau radiation records, it is hoped that contributions to the knowledge of solar radiation availability will be made.

If reliable data on rates of direct and diffuse radiation are known, the performance of a flat-plate solar energy collector may be studied. Fig. 1 schematically shows the operation of such a collector with q_D the incident direct radiation, q_d the incident diffuse radiation, q_o the rate of heat loss from the plate through the glass covers, and q_B the rate of heat loss from plate through the insulation on the back side. For an ideal collector in steady-state operation with a uniform plate temperature t_p, the rate of heat collected per square foot of collector area is

$$q_c = (\tau\alpha)_D q_D + (\tau\alpha)_d q_d - (q_o + q_B) \quad \ldots\ldots(1)$$

where

τ = the transmissivity of the glass covers.

α = the absorptivity of the blackened collector plate.

If

$$(\tau\alpha)_t = [(\tau\alpha)_D q_D/(q_D + q_d)] + [(\tau\alpha)_d q_d/(q_D + q_d)] \quad \ldots\ldots(2)$$

then

$$q_c = (\tau\alpha)_t (q_D + q_d) - (U_o + U_B)(t_p - t_a) \quad \ldots(3)$$

where

t_a = outside temperature.

U_o and U_B = coefficient of heat transfer through the glass covers and the insulation on the back side, respectively.

The efficiency of collection is

$$\eta_c = q_c/(q_D + q_d) \quad \ldots\ldots(4)$$

Hottel[3] has presented data giving $(\tau\alpha)_t$ as a function of angle of incidence for a system of 2 or 3 glass covers with a blackened collector plate. An equation for calculating the loss factor U_o through the glass covers has been given by Hottel and Woertz[4].

Useful conclusions may be drawn from analyses of ideal collectors. Such analyses have been presented in a previous paper[5]. However, theoretical analyses are not sufficient to allow design of a flat-plate collector. Additional factors which must be

*Professor and Head, Department of Mechanical Engineering, University of Minnesota. Member of ASHAE.

**Associate Professor, Department of Mechanical Engineering, University of Minnesota. Member of ASHAE.

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[1]Exponent numerals refer to References.

studied include optimum tube size and spacing, optimum tube arrangement on the plate, and optimum fluid flow rate. The method of attachment of the tubes to the plate is important. The length of time required to warm a cold collector to operating temperature must be determined.

Adequate design information on flat-plate collector performance has not yet been published. In papers by Hottel[3] and by Hottel and Woertz[4], substantial contributions have been made. G. O. G. Löf[5] has reported test information on collectors of the overlapped glass plate type.

At Minnesota a research program on flat-plate collectors is now in progress. This program includes a fundamental study of heat transfer from collector plate to fluid and a comprehensive experimental program on several flat-plate type collectors.

Description of Equipment

Fig. 2 schematically shows the major components of the experimental collector system excluding the temperature measurement equipment. In general the system consists of 2 collector units, 2 fluid transport circuits, 2 fluid-flow control systems, 2 insulated open fluid storage tanks, 2 circulating pumps, 2 refrigeration systems, and an air compressor for the pneumatic control systems.

Each collector unit consists of a wood exterior shell stiffened by 2 x 4 in. wood framing on the top, bottom, and back sides. Inside the shell is a 4 in. course of slab cork insulation. An insulated recess 7 ft-1 in. wide by 3 ft-3 in. high by 8 in. deep provides the space in which the collector plates are placed. A geared tilting mechanism allows positioning of the face of the collector in any position from horizontal to vertical. The collectors are mounted in a due south facing position on the roof adjacent to the laboratory. Fig. 3 is a photograph showing the front of the collectors while Fig. 4 shows the back sides of the collectors.

Several collector plates have been designed for placing in the collector units. At present 2 plates with serpentine type coils placed on the front side of the plates have been installed. Two header-type coils will later be constructed. The 2 plates now in use are painted black and have 3/8 in. O.D. copper tubing spaced 6 in. on centers soldered to the 0.02 in. thick copper plate. The black paint used has an absorptivity for sunlight of approximately 0.96. Investigations are now in progress to determine the optimum type of paint and details in

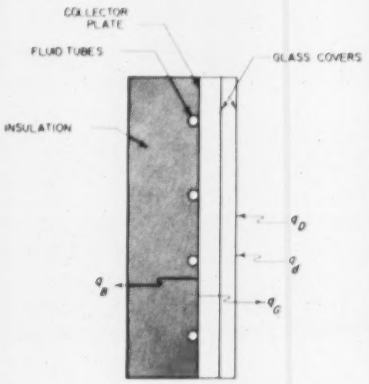

Fig. 1—Schematic flat-plate solar energy collector

this regard will be reported later. Each collector plate has dimensions of 7 ft-1 in. wide by 3 ft-3 in. high. The copper plates are attached to a light wood frame which has a depth dimension of about 8 in. The construction of the 2 plates is identical except that the collector shown on the left in Fig. 3 has been designated as a control collector and its plate has more elaborate thermocouple provisions. Each collector plate is provided with immersion thermocouples located in the fluid lines immediately behind the plate for measurement of entering and leaving fluid temperatures. The plate used in the left unit of Fig. 3 has an additional 19 immersion thermocouples distributed throughout the length of the plate tubing and 25 thermocouples soldered to the back side of the plate. The plate used in the right unit of Fig. 3 has 4 plate thermocouples besides the 2 fluid-in-and-out thermocouples. The thermocouples of both plates are led to weatherproof connection boxes placed on the back sides of the units.

The glass covers are mounted in rubber and supported by a steel frame. The outer glass cover is tightly sealed in its rubber mounting while the rear glass cover is loosely mounted to provide breathing action for the space between the panes. A breather vent from the space behind the rear glass to the outside is provided. The spacing between the 2 glasses is approximately 1 in. and the rear glass is mounted about 1 in. in front of the collector plate. At present, 1/4 in. *water white* (low iron content, high transmittance) plate glass is used as covers on both units. It is planned that these same glass covers will be used in the control collector for all experiments while different glass and probably plastic covers may be tested in the other unit.

The fluid piping, thermocouples, and wiring for the plate thermostats are led from the collector units back to the equipment room in a wood conduit filled with rock wool insulation. This conduit is shown in Fig. 4. Fluid connections from the copper tubing in the conduit to the collector units is made by use of flexible tubing to allow change of collector tilt. A system of by-pass valves at the end of the conduit next to the collectors is provided to allow recirculation of fluid in the outside lines back to the building before commencing operation in cold periods.

All equipment and instruments except the 2 collectors are located in a room immediately adjacent to the roof where the collectors are mounted. The location of this room relative to the collectors is shown in Fig. 4.

A 50-50 mixture by volume of ethylene glycol and water is used as the transport fluid. Major components of the fluid system located in the equipment room include 2 circulating pumps, 2 flow control valves, 2 flow measurement sensing elements and the 2 storage tanks.

Each circulating pump is a positive displacement impeller type rated

at 1.76 gpm at 40 psi head pressure. As shown by Fig. 2, each pump may take its suction from either tank. A relief valve on the discharge side of each pump provides a by-pass back to the respective storage tank during times that the flow control valve is modulating the flow through the collector. Each fluid storage tank has a capacity of approximately 40 gal and is insulated with about 3 in. of glass wool. A refrigerant evaporating coil is placed in each tank.

Two refrigeration systems are provided for removing the energy absorbed by the transport fluid in the collectors. Each system uses dichlorodifluoromethane as the refrigerant and the condensing units are air cooled. One ¾ hp unit serves 1 tank and a ½ hp unit serves the other. The evaporators are helical coils made from ⅝ in. O.D. copper tubing and are immersed in the fluid in the storage tanks. Each evaporator is supplied refrigerant by a thermostatic expansion valve. As shown by Fig. 2, the transport fluid piping is arranged so one refrigeration system may cool the fluid from both collectors, or both refrigeration systems may be operated if one unit does not have adequate capacity. Fig. 5 shows a view of the refrigeration systems and the fluid storage tanks.

Temperature, Flow and Radiation Measurements

Instrumentation of the system was designed for recording of the most critical data so that a minimum of labor would be needed in conducting tests. Fig. 6 shows the recorder panel in the equipment room. The two units on the left are electronic-pneumatic controllers for operation of the fluid control valves. The two circular chart units next to the center of the panel are electronic recorders for measurement of fluid flow to the collector units. The two strip chart recorders on the upper right end of the panel are for recording of the output of two Eppley pyrheliometers. The strip chart recorder at the lower right corner of the panel is a temperature recorder for 16 thermocouples. All recorders function on the electronic continuous balance principle.

In the control collector, 21 fluid thermocouples and 25 plate thermocouples are installed. In the other collector, 3 fluid and 4 plate thermocouples are installed. Including 2 thermocouples for outdoor temperature, a total of 55 temperature measurements at the collectors are possible. Of these, 16 may be automatically recorded and the remainder are read from an indicating potentiometer of the electronic self-balancing type.

Measurement of fluid flow is accomplished by employing a sensing element, a converter, and an electronic potentiometer. Fig. 2 schematically shows the location of the sensing elements. Each sensing element consists of a housing for direct mounting in the flow line containing a rotor which spins at a rate proportional to the fluid velocity. The sens-

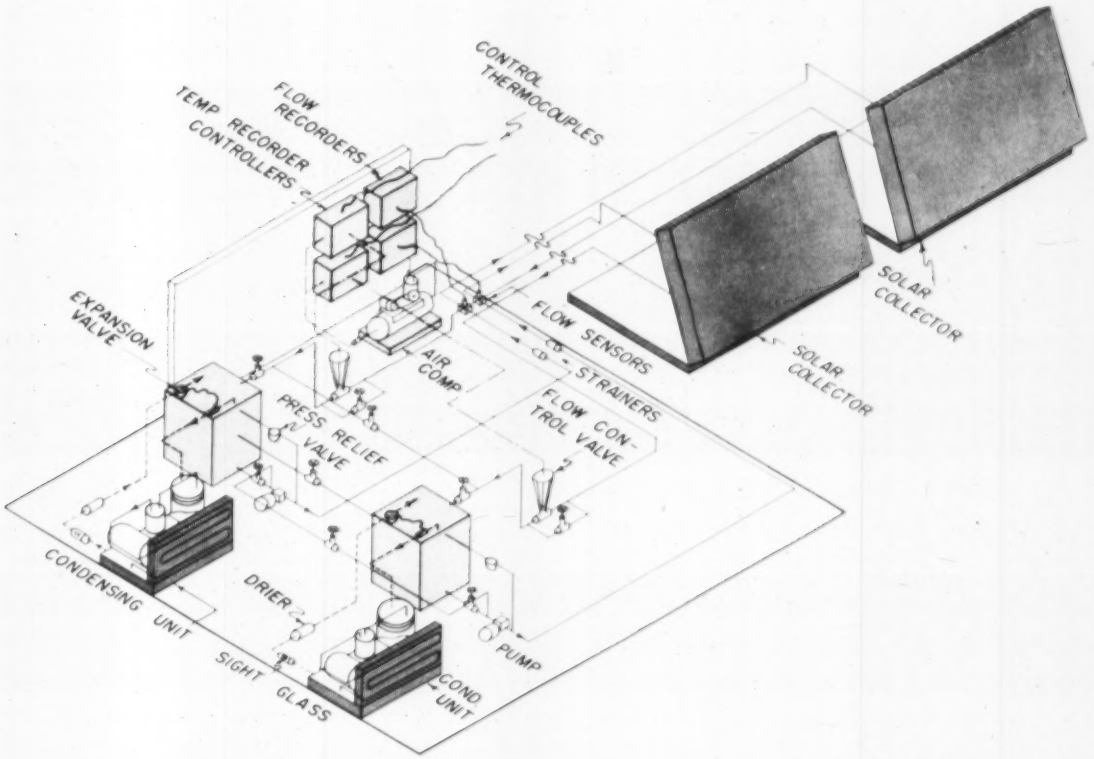

Fig. 2—Major components of experimental collector system excluding temperature measuring equipment

ing element produces an a-c output whose frequency is directly proportional to the rate of flow. The converter delivers a d-c voltage output proportional to the frequency of the a-c voltage of the sensing element. The potentiometer measures the d-c output of the converter and records it as flow.

During operation of the collectors, the incident radiation is measured by an Eppley pyrheliometer mounted at the side of the collector face parallel to the collector plate and in line with the center of the plate. Separate pyrheliometers are used for each unit to allow testing with different tilt positions. The d-c output of the pyrheliometers is recorded on strip chart recorders and the millivolt record is converted to Btu per (hour) (square foot) units. Calibration of the pyrheliometers was made at the ASHAE Laboratory at Cleveland.

In addition to use of the pyrheliometers in the collector studies, a separate research program on incidence of solar radiation is planned. Two pyrheliometer mounting stands with altitude and azimuth adjusting mechanisms have been constructed. Shading rings are now being built which will allow separate measurement of direct and diffuse radiation.

Fig. 3—Front side view of solar collectors

System Control

The collector system is designed for essentially complete automatic control during a single day's operation. This requires control of fluid flow and control of the operation of the refrigeration compressors, fluid pumps, and the air compressor.

In some experiments constant fluid flow through the collectors will be permitted but, in a majority of runs, modulating control of fluid flow to maintain a constant outlet fluid temperature at the collector or a constant plate temperature is planned. This control is accomplished by use of a pneumatically operated diaphragm motor valve placed in the fluid flow line and controlled by an electronic potentiometer linked to a pneumatic control unit. Fig. 2 schematically shows the location of the flow control valves while Fig. 5 shows a partial view of them.

Control of the refrigeration systems is accomplished through on-off operation of the compressors. A conventional type thermostat with a remote sensing element is wired directly in the compressor motor circuit. The sensing element is placed in the fluid storage tank next to the pump suction. The refrigeration system then operates to maintain an approximately constant temperature at the pump suction and thereby allows maintenance of an approximately constant fluid inlet temperature at the collector.

Operation of the air compressor for the pneumatic control system is controlled by a pressure switch which cycles the air compressor motor to maintain a constant receiver pressure.

Control of the operation of the fluid pumps is accomplished by use of plate thermostats. This control arrangement is a modification of a domestic electronic flow modulation system. Each system consists of a

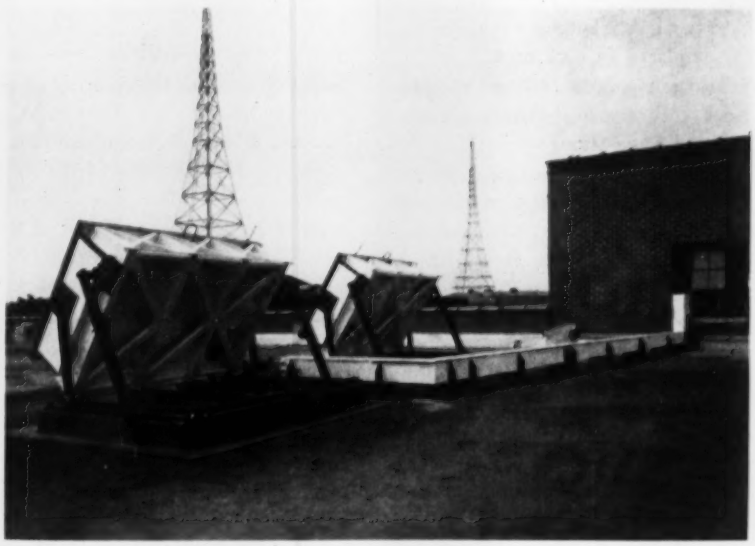

Fig. 4—Back side view of solar collectors

plate thermostat, an electronic relay amplifier, a switching relay, and a remote control point adjustment. The temperature sensitive resistance element of a wall-mounted thermostat was removed and attached to the back side of the collector plate. The wall thermostat case with its potentiometer and slider is mounted in the equipment room and the resistance element is wired back to it. The remote control point adjustment may be set at any temperature between 30 and 160 F. Each control system functions to start its fluid pump when the plate has reached the desired temperature and to stop the pump when the plate temperature falls below the desired value.

Acknowledgments

A number of individuals and organizations have aided greatly in the design and development of these facilities. Both technical advice and help have been forthcoming from personnel of the University of Minnesota Mechanical Engineering Department not directly concerned with the project but who have assisted willingly on a number of occasions. Frank Traeger, Paul Dotray, William Owen, and John Peterson, students employed on the project, have contributed many valuable ideas and enthusiasm beyond that normally to be expected. In particular, acknowledgment is made to the generous assistance, both financial and technical, of Minneapolis-Honeywell Regulator Co., who made possible control and recording equipment, in several cases unique, so necessary for the proper operation of the system and the project. E. F. Snyder, Jr., has been particularly helpful both through support and advice given on many different occasions. K. M. Lang, director of Engineering Research, Pittsburgh Plate Glass Research Laboratory, kindly arranged for the special glass covers used initially on the absorbers. G. V. Parmelee, C. M. Humphreys and E. R. Kaiser, of the ASHAE Research Laboratory in Cleveland, provided assistance both through valuable advice and through calibration of the pyrheliometers with special equipment which the Laboratory possesses.

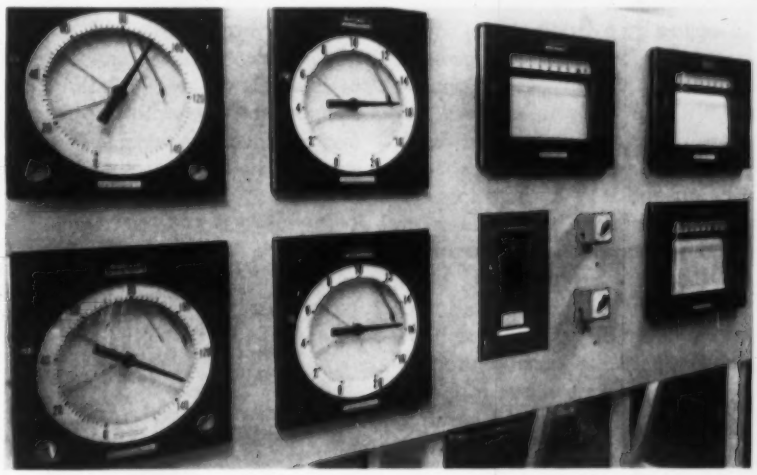

Fig. 6—Recorder and controller panel in equipment room

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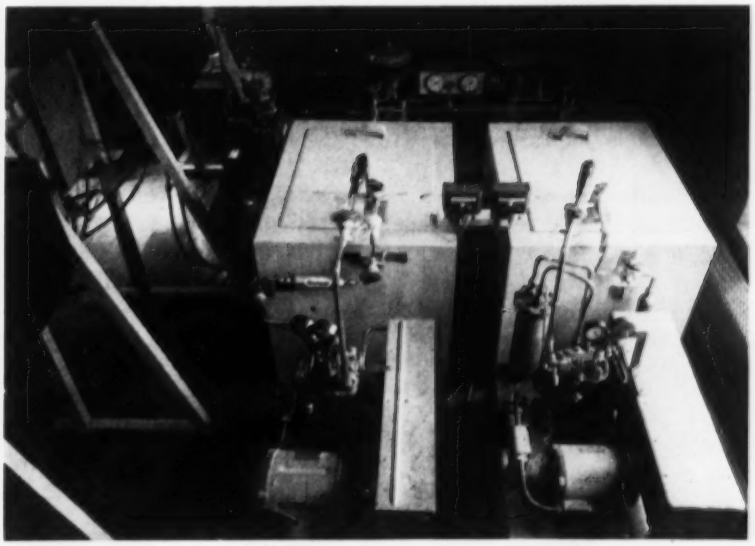

Fig. 5—View of refrigeration systems and fluid storage tanks with flow control valves and air compressor in background

EVAPORATIVE COOLING

By A. J. Hess*, Los Angeles, Calif.

Cooling by evaporation in some form is almost always a part of the process of summer air conditioning. The body uses this form of cooling to dissipate a portion of the heat generated in the process of living and it is the heat loss by evaporation from the surface of the skin that is used to regulate the body temperature.

A majority of large refrigeration systems ultimately reject the heat picked up in the cooling process by utilizing evaporation. In many areas of the country the natural temperature of evaporation (wet bulb) is sufficiently low so that when air is cooled to this temperature by the process of evaporation, the resultant product can be used directly for air conditioning. This is true through many areas of the West and Southwest. Evaporative cooling is thus an important process in our field of endeavor and warrants attention by the Society. Generally speaking, systems that use the evaporatively cooled air directly for air conditioning are cheaper to install and to operate than those using conventional refrigerative type cooling.

Old But Little Known

Evaporative cooling is probably one of the oldest forms of cooling known to man. It is known that many of the ancients used it for comfort cooling, notably the Egyptians. It has only been in the last 20 years, however, that it has come to be a recognized part of the art of air conditioning. Evaporation is a natural phenomena and nearly everyone is familiar with it to some extent, but it

is strange how little is known about the mechanics of this important air cooling tool.

Even less is known about the use of evaporatively cooled air for air conditioning. Most installations in use today were designed by rule-of-thumb methods and very sketchy ones at that. Yet there are a great number of installations throughout the world providing comfort to many who otherwise would be compelled to exist under almost unbearable conditions. In fact the process has come into use to the point where a considerable number of large factories are manufacturing equipment for evaporative cooling.

Our Government is a large user of this form of cooling, especially in Army, Navy and Air Force bases and some Society members felt embarrassed at the lack of information on evaporative cooling available to give the government engineers with which to design installations.

TAC Started in 1955

Early in 1955 some members recognized that an agency was needed within the Society to remedy any lack of attention to a subject of such importance. As a result the Technical Advisory Committee on Evaporative Cooling was organized and started to function. As presently organized the TAC consists of three subcommittees to work in the following evaporative cooling fields:

1. Evaporative Condensers
2. Cooling Towers
3. Air Cooling

The sub-committee on Air Cooling has been very active and this is commendable, since it is this phase of evaporative cooling that has been most neglected. In the short time since its organization, the committee only had time to survey the problem and plan the attack. At the 1955 Semi-Annual Meeting in San Francisco, the TAC lent its support to providing a symposium on evaporative cooling wherein it was possible to appraise the present status of the art and the extent of present day knowledge of its principles. Ultimately the committee plans to ask the Society to sponsor research on this important subject. It is also felt that THE GUIDE should contain what information the Society does have on evaporative cooling.

*Chairman, Research Technical Advisory Committee on Evaporative Cooling.

THE INDIRECT EVAPORATIVE AIR COOLER

By J. R. Watt* and R. A. Bacon**, Austin, Tex.

SUMMARY—The use that has been made of the indirect evaporative cooler in southwestern and western United States is discussed in the first part of this paper. Typical installations are described and their performance is outlined.

The second part describes 5 indirect evaporative coolers which were built and tested† at The University of Texas, 3 of which were single-stage and 2 were double-stage. Two of the units contained finned-tube and the other 3 contained plate-type heat exchangers. Capacity and other performance data about each of the machines are included. The cooling effectiveness and the overall heat transfer coefficient from one of the plate-type heat exchangers are plotted vs. the velocity of dry-air flow through the exchanger.

TWENTY YEARS ago, thousands of Arizona and California business establishments and homes were cooled by air conditioners using evaporating water to chill air without humidifying it. Largely forgotten today, these indirect evaporative coolers usually had either finned-coil or plate-type heat exchangers.

A finned-coil cooling system comprised an oversize natural-draft cooling tower, a pump, a fan delivering air indoors, and a copper radiator for cooling it. Automobile radiators served until specialized types appeared.

Given low local humidity, the cooling towers (about 4 × 8 ft × 20 ft high for residences) often delivered water 35 deg below outside dry-bulb temperature or within 3 deg of outside wet-bulb temperature. The water was pumped through radiators having from 4 to 8 rows of tubes, and counter-flow to air drawn through by the fan. Since the air often emerged within 1 deg of entering water temperature, many systems delivered it only 4 deg above outside wet-bulb temperature, or frequently 30 deg or more below outside dry-bulb temperature.

The most successful installation was probably the regenerative system in the University of Arizona Administration Building. This operated continuously from 1936 until 1952, when it was supplanted by campus-wide refrigeration. The original cooling tower, built into the two-story building, was a vertical shaft of 4 × 5-ft cross section extending from basement to attic. About 135 gpm of water sprayed down through 16,000 cfm of air, largely made up of cool returns from the rooms, rising upward. The counterflow, multi-row radiator then cooled 10,800 cfm of filtered outside air which was ducted throughout the building. The cool and humid tower air escaped through the attic to dissipate roof heat.

Delivered air temperatures were unusually low, because the regenerative return air reduced tower wet-bulb temperatures below those outside, allowing lower water temperatures and increased output. Indoor conditions thus averaged at least 15 deg below outside temperature.

The estimated 42 tons of cooling required only 17½ hp, plus water consumption comparable to corresponding refrigeration systems. The only moving parts were 2 centrifugal fans and a pump, aside from 10 tons of supplementary refrigeration used in humid weather.

This cooling system received only filtered air and softened water plus a weekly tower flushing. Many Arizona installations accumulated air- and water-borne minerals in the water until scale lined the radiator tubes and reduced efficiency. Seasonal radiator cleanings caused frequent replacement until wartime shortages intervened.

Many systems survived in California, and installations are made there today. Redwood towers with water-treatment and monthly contract cleaning are combined with multi-pass radiators with removable headers. With air and water velocities around 600 and 200 fpm, respectively, such coils cool air virtually to entering water temperature. Occasional towers are two-stage, the better to approach wet-bulb temperature. Many systems serve as complete cooling plants; others merely precool for refrigerated air conditioning.

Some systems, on the other hand, have direct-evaporative second stages, the dry-cooled air being further chilled by adiabatic humidification in air washers or saturated pads. Since indirect cooling lowers the wet-bulb temperature of air, the direct second-stage often delivers air several degrees below outside wet-bulb temperature. Such cooling is necessarily used like single-stage direct-evaporative cooling. As delivered air frequently exceeds 70 percent relative humidity, all fresh air is used without recirculation.

The plate-type indirect evaporative coolers originated in Los Angeles. About 1930, massive plate-type air-to-air heat transfer units were installed to cool several large buildings. More compact machines were installed widely in chain store buildings.

These coolers consisted of multiple, hollow, galvanized plates, 2 ft wide,

*Associate Professor of Mechanical Engineering, The University of Texas. Member of ASHAE.

**Assistant Professor of Mechanical Engineering, The University of Texas.

For presentation at the Semi-Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR CONDITIONING ENGINEERS, Washington, D.C., June 1956.

†Sponsored by U. S. Naval Civil Engineering Research and Evaluation Laboratory, Port Hueneme, Calif.

5 ft tall and 5/16 in. thick. Spaced ¼ in. apart, these formed narrow parallel flues separated by thin metal. One fan drew filtered outside air and fine water spray down between the plates, cooling them by evaporation. Another fan drew filtered outside air upward inside the plates and delivered it to the building. The water was filtered to protect the spray-nozzles, and the wet air was discharged direct to outdoors or through attic space.

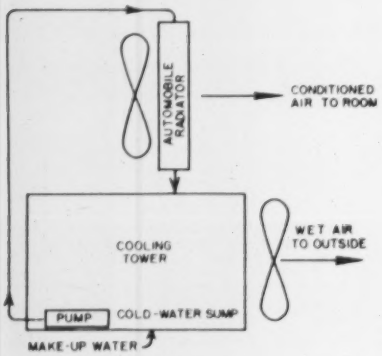

Fig. 1—Indirect evaporative cooler with finned coil

These systems gave economical cooling with all fresh air. One that was installed in Tucson in 1936 had 20,000 sq ft of cooling surface to produce about 60 tons of cooling effect from 191½ hp. It was still operating in 1955 and required little attention other than occasional servicing of clogged nozzles and rusted wet-air fan blades.

Aside from the traditional types, new designs have appeared. In one Texas residential system, 4 automobile radiators connected in a closed water circuit formed tower and cooling coil. One fan drew make-up and return air, plus a city-water spray, over 2 radiators and discharged them. The closed-circuit water, cooled by evaporation in these 2 radiators, flowed to the other 2 where it chilled the supply air for the rooms. Under test, 5/6 hp cooled 3700 cfm of air to 10 deg above ambient wet bulb. The spray water was discharged onto the flat roof.

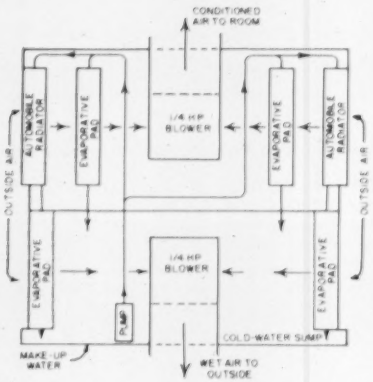

Fig. 2—Two-stage evaporative cooler. Conditioned air indirectly cooled and then evaporatively cooled

One type of indirect evaporative cooler resembles regenerative air preheaters used in power plants. A porous heat-transfer wheel packed with aluminum wool revolves 20 to 30 rpm. It is supplied with evaporatively cooled return air through part of its area. This air chills the aluminum wool to below outside wet-bulb temperature, and the wool then revolves into the path of filtered, dry outside air flowing to the rooms. After cooling the room air to near wet-bulb level, the packing revolves back for rechilling.

Table 1—Performance of 2-Stage Finned-Coil Cooler

	Run 1	Run 2
Volume of conditioned air, cfm	2000	2000
Power supplied, hp	5/6	5/6
Outside air db temp, F	99.1	88.2
Outside air wb temp, F	76.5	74.4
Outside air relative humidity, %	37	52
Air from cooling coils, db temp, F	86.7	80.5
Air from cooling coils, wb temp, F	75.3	71.8
Air from cooling coils, relative humidity, %	55	67
Heat removed by cooling coils, Btu per min	420	260
Heat removed by cooling coils, tons per hp	2.5	1.6
Cooling effectiveness of cooling coils, %	55	56
Cooling rate of cooling coils, Btu per (min) (F deg of wb depression)	19.3	19.6
Air from second stage pads, db temp, F	75	72.3
Air from second stage pads, wb temp, F	72.5	71.8
Air from second stage pads, relative humidity, %	96	96
Conditioned air total db temp, decrease, F deg	26.1	15.9
Conditioned air total sensible heat removed, Btu per min	760	465
Conditioned air total sensible heat removed, tons per hp	4.60	2.80

Experiments in Indirect Evaporative Cooling

In 1952 and 1953 the University of Texas conducted research upon indirect evaporative coolers. Five types were tested, including 2 finned-coil and 3 plate-type units, one of each being two-stage.

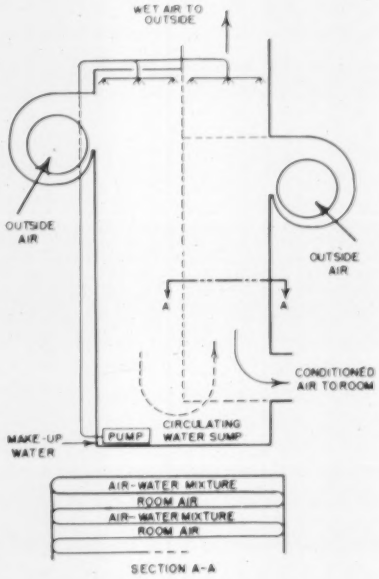

Fig. 3—Indirect evaporative cooler with folded plate-type heat exchanger

One finned-coil system with an oversize horizontal forced-draft redwood cooling tower, illustrated in Fig. 1, circulated water at only 1 deg above outside wet-bulb temperature through a new fan-equipped automobile radiator. Tests showed that 11.8 gpm of water flowing through the single-pass radiator cooled 1490 cfm of air to 5.5 deg above outside wet-bulb temperature. The air was cooled 6.3 deg and the wet-bulb depression was 11.8 deg, which gave a cooling effectiveness[‡] of 54 percent.

Lesser water rates resulted in warmer radiator water and warmer

‡Cooling effectiveness is the ratio of dry-bulb temperature decrease to outside-air wet-bulb depression.

air. Flow of 3.8 gpm gave air 9.3 deg greater than outside wet-bulb temperature and a cooling effectiveness of 46 percent, the air rate being 1490 cfm as before. The cooling rate was 11.6 Btu per (min) (F deg of wet-bulb depression), whereas a water rate of 11.8 gpm gave 13.4 Btu per (min) (F deg of wet-bulb depression).

The second finned-coil machine, illustrated in Fig. 2, was two-stage. Outside air drawn through the automobile-type radiators was cooled by heat removal and then passed through wet aspenwood pads, which formed the second stage, in which it was adiabatically cooled. The lower chamber formed an induced draft cooling tower. Enclosed by aspenwood pads kept wet by recirculating water, the lower blower drew air through them and discharged it below. Water circulated from the sump through the radiators, with some bypassed to the second stage pads, and then through the cooling-tower pads. The performance of this machine is shown in Table 1.

The dry-bulb temperatures of the conditioned air delivered were below outside air wet-bulb temperatures in both runs. They were below the 80 F dry-bulb temperature commonly needed for comfort, and, hence, there might have been less cooling in the pads, with the air delivered still being at satisfactory temperature and at lower relative humidity.

Heat removed in the cooling coils was over half of the sensible heat removed. Cooling effectiveness of 100 percent in the coils would realize the full potential of cooling that could be achieved by use of the pads alone and with the added advantage that the conditioned air would have less humidity.

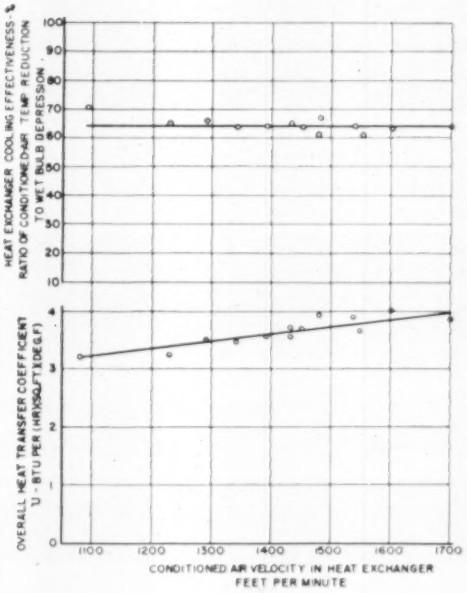
HEAT EXCHANGER COOLING EFFECTIVENESS-% RATIO OF CONDITIONED AIR TEMP. REDUCTION TO WET BULB DEPRESSION
OVERALL HEAT TRANSFER COEFFICIENT U - BTU PER (HR)(SQ FT)(DEG F)
CONDITIONED AIR VELOCITY IN HEAT EXCHANGER FEET PER MINUTE

Fig. 4—Cooling effectiveness and overall coefficient of heat transfer at various velocities in the indirect evaporative cooler illustrated in Fig. 3

The first plate-type cooler, illustrated in Fig. 3, was composed of a vertical casing enclosing on the left a spray chamber and on the right a sheet-aluminum heat exchanger whose metal folds formed multiple hollow plates spaced 3/8 in. apart. These spaces provided a continuation of the spray chamber wherein falling water sprays mixed with rising air and absorbed heat from the dry air through the metal that it continuously wetted. The dry air and the air through the spray chamber were driven by separate blowers. The sprays in the chamber on the left proved needless, so tests were conducted without them.

This machine's overall heat transfer coefficient varied between 3 and 4 Btu per (hr) (sq ft) (F deg), as shown by the curve in Fig. 4, and the dry air was cooled to over 60 percent of the prevailing wet-bulb depression.

The second plate-type indirect evaporative cooler, illustrated in Fig. 5, was similar to the one illustrated in Fig. 3. A housing enclosed a corresponding vertical heat exchanger with hollow plates 1/4 in. thick and spaced 1/4 in. apart. One blower supplied both wet-side and dry-side air, and a damper provided a control for

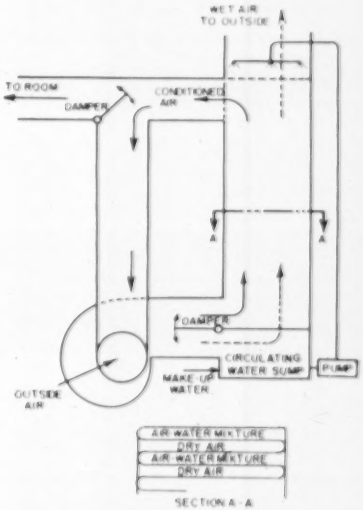

Fig. 5—Regenerative indirect evaporative cooler with folded plate-type heat exchanger

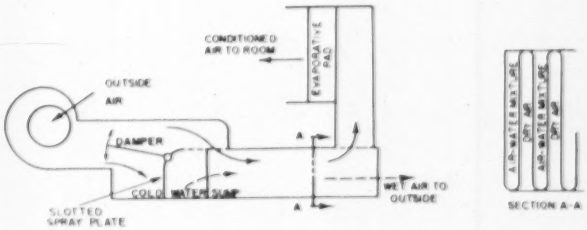

Fig. 6—Horizontal two-stage evaporative cooler. Slotted plate gives air-blown water spray

the division of the discharge from it. Air flow was upward in both sides, and water sprayed downward in the wet side. A damper at the dry-air discharge provided a control for recycling any part of the air from it into the blower to test for regeneration effects.

No appreciable regeneration gain was achieved. When — the outside wet-bulb depression being 20 deg — 10 percent of the dry air was recycled, it was delivered no cooler than when none of it was recycled. Larger proportions being recycled gave no measured improvement, and, of course, recycling reduced the amount of air discharged for comfort cooling. The blower discharged 60 percent of its air into the wet side and 40 percent into the dry side. Recycling 10 percent of the dry air provided only 4 percent of the air for the blower, the other 96 percent being outside air; recycling 100 percent of the dry air provided only 40 percent of the air for the blower and produced no air for comfort cooling. Regeneration by using cool return room air through the wet side is advantageous, however, for this commonly provides the blower with air having lower wet-bulb temperature than recycling does. Overall heat transfer coefficients were found to be from 4 to 6 Btu per (hr) (sq ft) (F deg), and cooling effectiveness was between 60 and 70 percent.

The third plate-type cooler, illustrated in Fig. 6, had a heat exchanger that was horizontal, and one blower supplied both wet-side and dry-side air. The slotted plate resembled a comb; all wet-side air passed through the slots and sprayed sump water into the heat exchanger. The cooler was equipped with a second stage for evaporative cooling.

The cooling effectiveness of the heat exchanger was between 40 and 50 percent. Water droplets did not carry well enough to wet the heat exchanger near the discharge end. The direct evaporative cooling stage cooled the air to between 2 deg below and 1 deg above ambient wet-bulb temperature.

References

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2. Air Conditioning for California Homes by B. M. Woods and B. F. Raber (*Agricultural Experiment Station Bulletin 589*, 1935. University of California, Davis, Calif.).

3. Evaporative and Surface Cooling, by C. S. Wilson and W. L. Dudley (*Washington University Engineering Experimental Station Bulletin No. 94*, 1937).

4. 100% Outside Air for Dallas Apartments (*Heating and Ventilating*, Vol. 35, No. 7, July 1938, pp. 37-38).

5. Cooling for the Arizona Home, by M. L. and P. M. Thornburg (*University of Arizona Agricultural Extension Bulletin No. 105*, May 1939, p. 14).

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7. *Refrigeration and Air Conditioning*, by B. F. Raber and F. W. Hutchinson (John Wiley & Sons, Inc., 1946, pp. 213-214).

8. A Two-Stage Evaporative Cooler, by R. A. Kennedy (Thesis for a Master's Degree, University of Texas, Austin, Tex., May 1953).

9. For Many Uses. . . Many Types of Evaporative Coolers, by R. S. Ash (*American Artisan*, August 1953, pp. 72-75).

10. Investigation of Evaporative Air Cooling, by J. R. Watt (*Report to U. S. Naval Civil Engineering Research and Evaluation Laboratory*, Port Hueneme, Calif., 1953).

PRESIDENT JAMES IN EUROPE

John W. James, President of the American Society of Heating and Air-Conditioning Engineers, left Chicago April 12 on a trip which takes him to London, Paris, Amsterdam, Brussels, Hanover, Stockholm, Oslo and Copenhagen. He plans to return the middle of May.

John W. James
Chicago, Ill.

During the trip, President James will not only take care of the interests of McDonnell & Miller, Chicago, of which firm he is vice president in charge of research, but will also visit the British Industries Fair, Brussels Trade Fair, Hanover Fair, Scandinavian Oil Burner Conference, and the Institute of Fuel Conference in London.

AIR-CONDITIONING SHOW SCHEDULED FOR CHICAGO

It is expected that all records will be broken at the 13th International Heating and Air-Conditioning Exposition when it opens in Chicago, February 25 to March 1, 1957. The Exposition will be held under the auspices of the ASHAE in conjunction with the Society's 63rd Annual Meeting with headquarters at the Conrad Hilton Hotel, February 25-28. In view of the profession's rapid technological advances, displays of exceptional novelty are anticipated, and according to the management, which is under the direction of International Exposition Co., New York, N. Y., the displays will completely occupy the great International Amphitheater in Chicago.

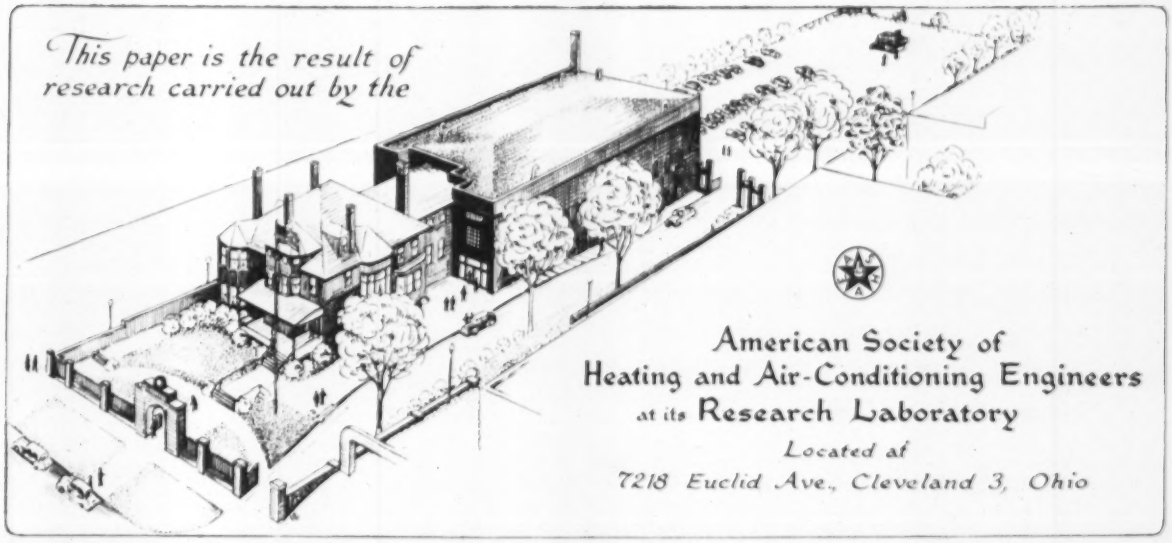
CUTLER RECEIVES ALUMNI SERVICE AWARD

Joseph A. Cutler, president and general manager, Johnson Service Co., Milwaukee, was the recipient of one of the first distinguished service awards to be given by the University of Wisconsin Alumni Club of Milwaukee. The award was presented to Mr. Cutler at a Founders' Day dinner held on February 2 at the Wisconsin Club.

J. A. Cutler
Milwaukee, Wis.

Mr. Cutler, a graduate of the University of Wisconsin, has served on the Athletic Board and the Executive Committee, taking an intensive interest in the University of Wisconsin Foundation. He is a past president of the *General Alumni Association*.

A Life Member of the Society, Mr. Cutler was a member of Council from 1920-26 and a member of the board of governors of the Illinois Chapter from 1922-27.


This paper is the result of research carried out by the
American Society of Heating and Air-Conditioning Engineers
at its Research Laboratory
Located at
7218 Euclid Ave., Cleveland 3, Ohio

NATURAL CONVECTION AND RADIATION IN A PANEL-HEATED ROOM

By T. C. Min*, L. F. Schutrum**, G. V. Parmelee†, and J. D. Vouris‡, Cleveland, Ohio

This paper is the result of research carried on by the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS at its Research Laboratory located at 7218 Euclid Ave., Cleveland 3, Ohio

SUMMARY — Natural convection coefficients and radiation interchange factors based on the experiments made in the ASHAE Environment Laboratory under floor panel and ceiling panel heating conditions are reported. Convection values obtained in the test room for the room surfaces and for a small free-edge plate, and values for small plates as reported by other investigators, are compared.

Convection from the heated ceiling panel was found to be considerably less than from a small downward-facing free-edge plate. Convection coefficients determined for other surfaces of the room compared favorably with values determined from similarly oriented, small heated plates.

Radiation exchanges between the heated panel and the room surfaces were measured with a radiometer and found to agree well with calculated values.

CONVECTION data previously available for panel heating design calculations are those obtained from experiments with heated wires, pipes, or small plates with free edges, or with parallel plates only a few inches apart. There has therefore been some uncertainty regarding the application of these data to panel heating. Under the guidance of the Technical Advisory Committee on Panel Heating and Cooling[6], research has been conducted in the ASHAE Environment Laboratory since November 1951 to develop basic information pertaining to panel heating and cooling applications.

In four previous papers [1-4] the total heat flow rates from ceiling panels and floor panels under specific conditions were reported. The influence of various factors affecting these heat flow rates were also reported and discussed. In order to provide a more general approach to design, this paper presents an analysis of the convection and radiation components of the total heat exchange at all the surfaces of a room heated by warm panels. The results of this study, with certain limitations, may be useful in solving panel heating problems of various degrees of complexity. The convection and radiation coefficients can be combined for estimating panel outputs, or they may be used separately as coefficients in rational design procedures such as Hutchinson's, or in the thermal-circuit approach to unsteady-state problems as advanced by Nottage.

Data were obtained mainly from the previous studies but include results from recent experiments. Ex-

*Research Engineer, ASHAE Research Laboratory. Junior Member of ASHAE.

**Research Supervisor, ASHAE Research Laboratory. Member of ASHAE.

†Senior Research Supervisor, ASHAE Research Laboratory and now with the Arabian-American Oil Co., Dhahran, Saudi Arabia. Member of ASHAE.

‡Assistant Research Engineer, ASHAE Research Laboratory and now with Army Ordnance, Philadelphia, Pa.

[6]P. B. Gordon, Chairman; W. S. Harris, Vice Chairman; A. B. Algren, W. P. Chapman, John Everetts, Jr., H. T. Gilkey, E. S. Howarth, L. N. Hunter, A. T. Jorn, W. C. Kadow, G. D. Lain, H. A. Lockhart, C. O. Mackey, R. L. Maher, S. K. Smith, E. F. Snyder, Jr., W. F. Spiegel, J. M. Van Nieukerken, G. L. Wiggs.

For presentation at the Semi-Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Washington, D.C., June 1956.

periments were made under steady-state conditions with a uniform environment, wherein all room surfaces other than the heated panel were at the same temperature, and with the entire floor or ceiling heated. Other reports on this program will follow.

Test Room and Apparatus

The ASHAE Environment Laboratory was described in a previous paper[5]. All 6 surfaces of the room are composed of aluminum panels, the temperatures of which are controlled by liquid circulation. The surfaces are instrumented for direct measurement of heat-flow rates and surface temperatures, and for these tests were painted with a semi-gloss gray paint over 2 coats of primer.

For radiation measurements, a sensitive radiometer[6] with its field of view restricted to narrow cone angles was used.

Procedure

The total exchange between a room surface and its environment is the sum of the convection exchange between the surface and the room air and the radiation exchange between this surface and the other room surfaces which it can *see*. In all cases total heat exchange in the Environment Laboratory was measured by plate-type heat-flow meters[7] distributed over and fastened to the room-side surfaces of the walls, floor, and ceiling. The problem, therefore, was one of separating this total exchange into its convective and radiative components.

The total heat output of the panel surface was measured directly by plate-type heat-flow meters, and the radiation output was subtracted from the total panel output to obtain the convection heat flow. The convection coefficient was then evaluated by dividing the convection heat flow by the temperature differences of the surface and the room air. The radiation exchange was measured with the radiometer at a number of heat-flow meter locations by sighting at the meter surfaces and obtaining the total radiant energy leaving them at a given angle, and then sighting in the opposite direction and measuring the total radiant energy impinging on them. For proper summation of the net radiation exchange, readings were taken at a number of positions over the hemisphere. The heat-flow meters were painted the same as the surface on which they were located for most of the radiation measurement. However, for a few tests some of the meters were covered with highly polished foil.

Tests in the Environment Laboratory covered the full range of panel and unheated surface temperatures encountered in practice. Floor panel temperatures were varied from 75 F to 110 F and ceiling panel temperatures from 90 F to 150 F. During both series of tests, the AUST* was varied from 40 F to 70 F. Tests were also made with three different sized rooms, 24½×12×8 ft; 24½×12×12 ft; and 12×12×8 ft.

A few tests were made to determine the convection heat transfer from an 11½ in. square plate in various orientations, with free and with baffled edges.

In most of the tests, the relative humidity was low, around 20 percent, and the effect of water vapor absorption and reradiation was not evaluated.

Radiation

Separation of the convective component from the total heat exchange at a room surface can be accom-

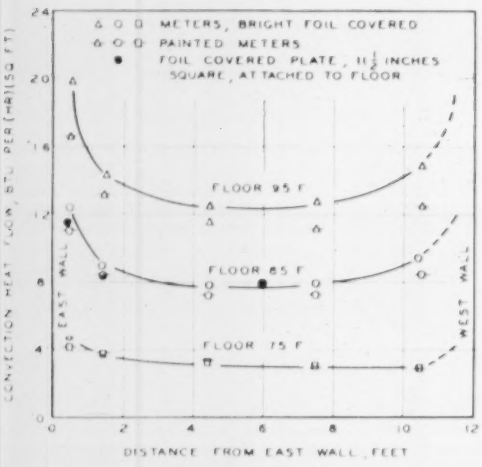

△ ○ □ METERS, BRIGHT FOIL COVERED
△ ○ □ PAINTED METERS
● FOIL COVERED PLATE, 11½ INCHES SQUARE, ATTACHED TO FLOOR
FLOOR 95 F
FLOOR 85 F
FLOOR 75 F
EAST WALL
WEST WALL
CONVECTION HEAT FLOW, BTU PER (HR)(SQ FT)
DISTANCE FROM EAST WALL, FEET

Fig. 1—Convection from Floor Panel (uniform environment, no infiltration, AUST 65 F, 24½ x 12 x 8 foot room)

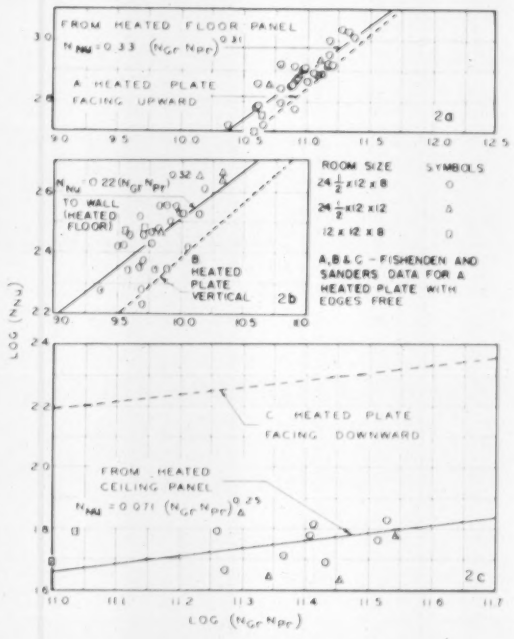


Fig. 2—Comparison of Natural Convection for Room Surfaces and Similarly Oriented Small Plates

*The area weighted average temperature of the unheated surfaces of the room. In a uniform environment, AUST equals the temperature of all surfaces other than the heated panel.

plished if the net radiant energy exchange can be evaluated. In radiation interchange between any 2 surfaces forming part of an enclosure, there are 2 factors involved besides the well-known Stefan-Boltzmann law for black-body radiations. These are: (1) the view the surfaces have of each other; and (2) their emitting and absorbing characteristics. The former involves a shape factor or view factor which takes into account both the shape and the relative position of the surfaces. Information concerning this has appeared elsewhere.[5-11] The latter so-called emissivity factor or *effective* emissivity depends upon the relative sizes, relative positions, shapes, reflection characteristics (diffuse or specular) and the individual emissivity of the surfaces.

The general equation for radiation interchange given by Hottel[11] is

$$q_r = F_{1\,2}\,\sigma(T_1^4 - T_2^4) \quad \ldots\ldots (1)$$

where

$F_{1\,2}$ = the interchange factor involving both items 1 and 2 as just stated.

When the reflections among 6 surfaces of a room are considered along with surface irregularities and the absorbing water vapor in the air, theoretically exact treatment of radiation exchanges is impractical. The procedure, then, was to rely on actual test measurements.

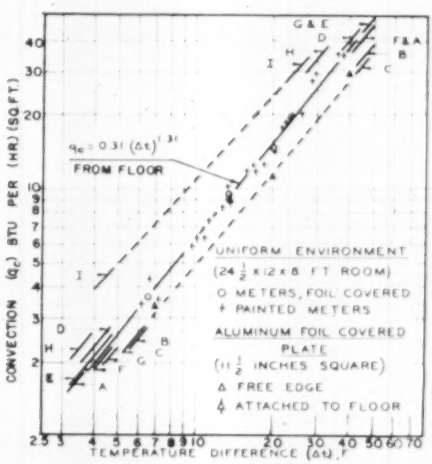


Fig. 3 — (left) Heat Transfer from Heated Floor Panel by Natural Convection

Notes for Fig. 3

A. Fishenden & Saunders — Turbulent Region Ref. 14.
B. Fishenden & Saunders — Turbulent Region (McAdams) Ref. 11.
C. Fishenden & Saunders — Streamline Region (L — 0.96 Ft) Ref. 14.
C'. Fishenden & Saunders — Streamline Region (L — De — 16.3 Ft) Ref. 14.
D. Griffiths & Davis Ref. 15.
E. Griffiths & Davis (McAdams) Ref. 21.
F. Heilman (Carroll) Ref. 20.
G. King Ref. 17.
H. Nusselt, Henky & Hottinger (Giesecke) Ref. 19.
I. Wilkes & Peterson Ref. 18.

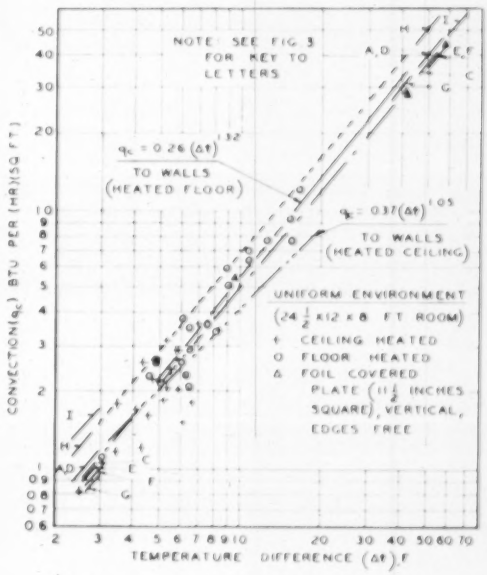


Fig. 4 — (right) Heat Transfer to Walls by Natural Convection

For accuracy in evaluating the radiation exchange, the simplest configuration possible was used, namely, all room surfaces except the heating panel at the same temperature. The average net exchange between the entire surface of the heated panel and the surroundings was determined from net exchange measurements at various locations on the surface. The interchange factor between the floor panel and its environment was found to be 0.876. If the surface is a perfectly diffusing emitter and reflector, *i.e.* obeys the cosine law, and if its

Nomenclature

A = area of a surface, square feet; A_1 refers to surface 1 (enclosed body); A_2 refers to surface 2 (enclosing body).
c = dimensionless exponent.
c_p = specific heat of air at constant pressure, Btu per (pound$_m$) (Fahrenheit degree).
D_e = equivalent diameter equals four times area divided by the perimeter of surface, feet.
ε = emissivity of surface for radiation, dimensionless; ε_1 of surface 1, ε_2 of surface 2.
F = overall interchange factor, dimensionless; $F_{1\,2}$ from surface 1 to surface 2.
$\bar{F}$ = black-surface overall interchange factor, dimensionless; $\bar{F}_{1\,2}$ from surface 1 to surface 2.
g = acceleration due to gravity, 4.17×10^8 ft per (hour)^2.
H = height of walls, feet.
h = coefficient of heat transfer, Btu per (hour) (square foot) (Fahrenheit degree); h_c for natural convection from a surface to ambient air; h_{rc} for combined coefficient for radiation plus convection.
k = thermal conductivity of air, Btu per (hour) (square foot) (Fahrenheit degree per foot).
L = characteristic linear dimension for convection, feet.
N_{Gr} = Grashof number, $B\rho^2 g L^3 \Delta t/\mu^2$, dimensionless.
N_{Nu} = Nusselt number, $h_c L/k$, dimensionless.
N_{Pr} = Prandtl number, $c_p\mu/k$, dimensionless.
q = rate of heat transfer, Btu per (hour) (square foot); q_c for natural convection, q_r for radiation.
T = absolute temperature, Rankine degree; T_1, temperature of surface 1; T_2, temperature of surface 2.
X = length of conduction path, feet.

Greek

α = dimensionless constant.
β = coefficient of volumetric expansion of air, reciprocal Rankine degree.
σ = Stefan-Boltzmann constant, 0.173×10^{-8} Btu per (hour) (square foot) (Rankine degree)^4.
Δt = temperature difference between surface and air, Fahrenheit degrees.
μ = viscosity of air, pounds$_m$ per (hour) (foot).
ρ = density of air, pounds$_m$ per cubic foot.

emissivity is independent of temperature, an interchange factor $F_{1\text{-}2}$ can be found from the following equation given by Hottel[13]

$$F_{1\text{-}2} = \frac{1}{\frac{1}{F_{1\text{-}2}} + \left(\frac{1}{e_1} - 1\right) + \frac{A_1}{A_2}\left(\frac{1}{e_2} - 1\right)} \quad (2)$$

The angular emissivity of the painted surfaces in the Environment Laboratory was measured by Umur, Parmelee and Schutrum[6] for incident angles up to 85 angular deg. This same report gave the hemispherical emissivity of the paint as 0.88 and normal emissivity of 0.92.

For the conditions existing in the test room average $F_{1\text{-}2}$ is unity for the floor panel and its environment; e_1 and $e_2 = 0.88$; and $A_1/A_2 = 300.9/884.2 = 0.34$. Applying these values to Equation 2, $F_{1\text{-}2}$ becomes 0.85 which compares favorably with the measured value of 0.876. Furthermore, the hemispherical emissivity of the panel surface, 0.88, is nearly the same as the observed interchange factor, 0.876. Therefore, the interchange factor for a panel in a completely enclosed space appears to be equivalent to the hemispherical emissivity of the panel surface ($F_{1\text{-}2} = e_1$). It is not known whether this is true for surfaces having low emissivities.

Although one would expect the interchange factor for the heated ceiling to be the same as for the heated floor panel, it was found to be 0.90, which is slightly higher than the 0.876 value for the floor. This may be due to the fact that meters installed on the ceiling were constructed with embossed aluminum foil instead of smooth foil as used on the floor meters. The added roughness of these surfaces would be expected to increase the radiation output.

The interchange factor for the polished foil covering on some of the meters was found to be 0.07 which is again in good agreement with Hottel's Equation 2, where A_1/A_2 approached zero, and the interchange factor $F_{1\text{-}2}$ equals the emissivity of the foil. The normal emissivity of highly polished aluminum foil is around 0.05[12] and the hemispherical emissivity would be about 0.06.

The interchange factor $F_{1\text{-}2}$, once established by measurement, was used thereafter to calculate the radiation exchange between the warm panel and its environment in the test room. The radiation transfer to the walls and the ceiling, from the heated floor panel, was obtained by distributing the net radiation output of the panel according to the shape factors between the panel and each of the other surfaces. This was possible because the ceiling and the walls were at the same temperature. The radiation exchanges with a heated ceiling were treated in a similar manner but were somewhat higher, since the interchange factor was 0.9 for the ceiling panel and 0.876 for the floor panel. This difference was judged not to be

Table 1 — Comparison of Test Apparatus, Test Conditions, and Natural Convection Equations for Plane Surfaces

Name of Investigator	Ref. No.	Apparatus	Size of Test Surface	Air Temperature	Temp. Difference	Convection Equations		
						Facing Upward	Vertical	Facing Downward
1	2	3	4	5	6	7	8	9
Fishenden and Saunders	(14)	Heated Plate	2 ft Square (Max.)	~	To Over 1000 F	Streamline Region $h_c^* = 0.27\ (\Delta t/L)^{0.25}$	$h_c^* = 0.28\ (\Delta t/L)^{0.25}$ Turbulent Region $h_c = 0.55\ (\Delta t)^{0.25}$	$h_c^* = 0.12\ (\Delta t/L)^{0.25}$ $h_c = 0.30\ (\Delta t)^{0.25}$
Fishenden and Saunders (McAdams)	(11)	Do.	Do.	~	Do.	Streamline Region $h_c^* = 0.27\ (\Delta t/L)^{0.25}$ Turbulent Region $h_c = 0.22\ (\Delta t)^{0.33}$	~ ~	$h_c^* = 0.12\ (\Delta t/L)^{0.25}$ ~
Griffiths and Davis	(15)	Heated Plate	3 to 4 ft sq	Room Temperature	Up to 212 F	$h_c = 0.4\ (\Delta t)^{0.25}$	$h_c = 0.3\ (\Delta t)^{0.25}$	$h_c = 0.2\ (\Delta t)^{0.25}$
Griffiths and Davis (McAdams)	(21)	Do.	Do.	Do.	Do.	$h_c = 0.38\ (\Delta t)^{0.25}$	$h_c = 0.27\ (\Delta t)^{0.25}$	$h_c = 0.2\ (\Delta t)^{0.25}$
Heilman	(16)	Heated Disk Heated Ribbon	3.47 to 9.97 in. 0.50 in. Wide to 2.108 in. Long	Air at Room Temperature	Zero to 700 F	$C = 1.79$	$h_c^{**} = C\Delta t^{0.266}/D^{0.27}T_{ave}^{0.181}$ $C = 1.594$	$C = 0.89$
Heilman (Carroll)	(20)	Do.	Do.	Do.	Do.	$h_c^{**} = 0.32\ (\Delta t)^{0.27}$	$h_c = 0.25\ (\Delta t)^{0.27}$	$h_c^{**} = 0.16\ (\Delta t)^{0.27}$
King	(17)	Correlated Data From Other Investigations				$h_c^{**} = 0.28\ (\Delta t)^{0.33}$	$h_c = 0.22\ (\Delta t)^{0.33}$	$h_c^{**} = 0.15\ (\Delta t)^{0.33}$
Nusselt and Henky (Griesecke)	(19)	~	~	~	~	$h_c = 0.48\ (\Delta t)^{0.25}$	$h_c = 0.38\ (\Delta t)^{0.25}$	$h_c = 0.22\ (\Delta t)^{0.25}$
Wilkes and Peterson	(18)	Heated Plate	8 ft by 2 ft 8 in. With 4 in. Air Space Between Surfaces	Air at About Room Temperature	8 to 28 F	$h_c = 0.83\ (\Delta t)^{0.32}$	$h_c = 0.5\ (\Delta t)^{0.32}$	$h_c = 0.38$
ASHAE Research Lab.		Environment Lab.	24½ x 12 x 12 ft (Max.) (See Paper)	Room Temperatures	Zero to 100 F	Floor Heated (From Floor or to Ceiling) $h_c = 0.39\ (\Delta t)^{0.31}/D_e^{0.08}$	To Walls (Floor Heated or Ceiling Heated) $h_c = 0.29\ (\Delta t)^{0.33}/H^{0.05}$	Ceiling Heated (From Ceiling or to Floor) $h_c = 0.041\ (\Delta t)^{0.25}/D_e^{0.25}$

*In Fishenden and Saunders' equations, L is the side length in feet; a mean value is taken for the side length if the plate is rectangular.

**Heilman's (References 16, 20) and King's (Reference 17) values for horizontal heated plates facing upward and downward were based on the percentage-wise distribution obtained by Griffiths and Davis (Reference 15). In Heilman's Equation, D is the diameter or length in inches, and $Tave$ is the average of surface and air temperature, Fahrenheit degrees absolute. Heilman suggested that, until further experimental work was done, 24 in. be taken as the limit for the size and height, and he assumed the heat loss becomes constant for heights greater than 24 in.

serious. It is interesting to note that the painted surface appeared to behave as a highly specular rather than as a perfectly diffuse reflector (see Appendix †). Nevertheless the specular reflections became diffuse after 2 or 3 reflections from other surfaces.

Convection

In a space entirely enclosed by a ceiling, floor, and walls, with no infiltration, natural convection is brought about by differences in density of the air caused by temperature differences. The rate of convection for plane surfaces depends upon the temperature differential and the film coefficient. The film coefficient is related to the mean temperature of the surface and air, temperature differences, size and position of the surface, boundary conditions, and the relative positions of other surfaces.

For natural convection, the film coefficient or convection coefficient h_c

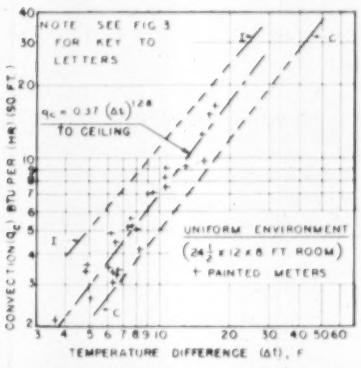

NOTE SEE FIG 3 FOR KEY TO LETTERS
$q_c = 0.37\ (\Delta t)^{1.28}$
TO CEILING
UNIFORM ENVIRONMENT
(24½ x 12 x 8 FT ROOM)
† PAINTED METERS
CONVECTION Q_c BTU PER (HR)(SQ FT)
TEMPERATURE DIFFERENCE (Δt), F

Fig. 5—Heat Transfer to Ceiling by Natural Convection (Room Heated by Floor Panel)

may be expressed in dimensionless terms by Nusselt, Grashof and Prandtl numbers[14] as follows:

$$N_{Nu} = a\ (N_{Gr}\ N_{Pr})^c \quad \ldots\ldots\ldots(3)$$

or

$$h_c L/k = a\ [(c_p\ \mu/k)(\beta\rho^2\ g\ L^3\ \Delta\ t/\mu^2)]^c \quad \ldots\ldots\ldots(4)$$

Once the constants a and c are evaluated from experimental data, the equation may be applied to similar problems as long as the shape and orientation of the system remain the same and the product of N_{Gr} and N_{Pr} is within the range of conditions used in the original evaluation.

† It is planned to publish Appendix with the paper in the ASHAE TRANSACTIONS 1956.

The physical properties of air, ρ, k, β, and μ are to be taken at the arithmetic mean of the surface and room air temperatures. In all cases in this report the room air temperature is the temperature at the 5-ft level at the center of the room.

The characteristic linear dimension L is one which relates the size of a surface of given shape and orientation to the convection coefficient. For example, for a long horizontal cylinder, the diameter affects the convection coefficient greatly, while the length has little effect. In the case of a horizontal square plane surface, the length of a side has been used as the characteristic dimension. For

Fig. 6—Interior View of Test Room showing Thermocouple Probe Apparatus used for Boundary Film Temperature Measurements

rectangular horizontal plane surfaces, such as the ceiling or floor of a panel-heated space, the characteristic dimension was taken as the equivalent diameter, which is defined as 4 times the hydraulic radius or 4 times the area divided by the perimeter. For vertical plane surfaces, such as walls, the height was the characteristic dimension used.

Correlation of Convection Data, Floor Panel Heating: Convection heat flow was obtained by subtracting the calculated radiation output from the total panel output as described before. The convection from the heated floor was found to be greater near the walls than in the center of the room, as shown in Fig. 1. This was due to the fact that the air near the walls was cooler and at a higher velocity than that at the center of the room. The average area weighed heat flow was, therefore, used for correlation.

The dimensionless groups for 34 tests were evaluated‡ with the equivalent diameter as the characteristic dimension, and correlated by the

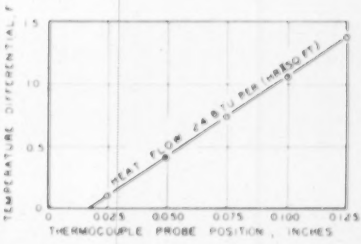


Fig. 7—Temperature Gradients in Laminar Boundary Layer Adjacent to Ceiling Panel (5½ feet from west wall, 120F ceiling, 65F AUST, no infiltration, uniform environment, 24½ x 12 x 8 foot room)

method of least squares. The analysis indicated that the convection from a heated floor may be represented by:

$$N_{Nu} = 0.33\ (N_{Gr}\ N_{Pr})^{0.31} \quad \ldots\ldots\ldots(5)$$

Convection from Heated Floor

The test data for the 3 room sizes are shown in the top curve Fig. 2a.

As the temperature range occurring in panel heating systems is small, the physical properties of air may be considered as constants. For practical computation, therefore, the heat transfer coefficient for natural convection may be correlated for a given orientation by means of 2 variables, *viz*: the temperature difference between the heat-transfer surface and the room air, and the characteristic dimension. Equation 5 may therefore be simplified to

$$h_c = 0.39\ [(\Delta t)^{0.31}/D_e^{0.38}] \quad \ldots\ldots\ldots(6)$$

Convection from Heated Floor

Equation 6 has been plotted in Fig. 3 for a room size 24½×12×8 ft (D_e = 16.3) and is compared with test data from that room. Curves of other investigators and additional

‡ All air properties were taken from *Thermodynamic Properties of Air*, by Joseph H. Keenan and Joseph Kaye (John Wiley & Sons, Inc., New York, 1945) and the HEATING, VENTILATING, AIR-CONDITIONING GUIDE 1955 (published by the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, New York).

test data for a free-edge small plate are also shown in the figure and will be discussed later.

The convection data for the four walls were rather scattered, especially for the north wall where a door is located. From the average of values for the other 3 walls, the convection coefficients were obtained from 25 tests and are expressed in dimensionless form as:

$$N_{Nu} = 0.22\ (N_{Gr}\ N_{Pr})^{0.32} \quad \ldots\ldots(7)$$

Convection to Walls, Heated Floor

The data, in form of Nusselt number and the product of Grashof and Prandtl numbers are shown in Fig. 2b.

Equation 7 may be simplified to

$$h_c = 0.29\ [(\Delta t)^{0.32}/H^{0.08}] \quad \ldots\ldots(8)$$

Convection to Walls, Heated Floor

The test data for one room size are shown in Fig. 4.

The convection to the ceiling when the floor is heated is shown in Fig. 5 and the convection coefficient may be expressed by

$$h_c = [0.58\ (\Delta t)^{0.25}/D_c^{0.16}] \quad \ldots\ldots(9)$$

Convection to Ceiling, Heated Floor

Correlation of Convection Data, Ceiling Panel Heating: Since the convection heat flow from a heated ceiling was found to be relatively small, slight errors in radiation measurements resulted in large errors in convection data. To reduce these errors, some of the heat-flow meters were covered with polished aluminum foil, thereby reducing the radiant heat flow and making the convection component a greater percentage of the total.

Convection from the ceiling was also determined directly by measuring the temperature gradient through the boundary air film and computing the heat conducted through this film. The temperature gradient was measured by a fine thermocouple, the position of which could be precisely determined. The device used for measuring this temperature gradient is shown in Fig. 6. The ceiling diffusers and fluorescent lighting shown in the figure were installed after the measurements reported in this paper were made. Typical experimental data obtained by this method are shown in Fig. 7. The conduction or the equivalent convection through this layer was then computed by the equation

$$q = -kA\ (dt/dX) \quad \ldots\ldots(10)$$

where

k = the conductivity of the air.

dt/dX = the temperature gradient, Fahrenheit degree per foot.

Investigation of the boundary layer thickness was not attempted; however, in one test, measurements were made as far as 0.75 in. from the ceiling and the gradient was still linear. Although most measurements were steady, variation in thermocouple output increased in amplitude and frequency with increasing distance from the ceiling.

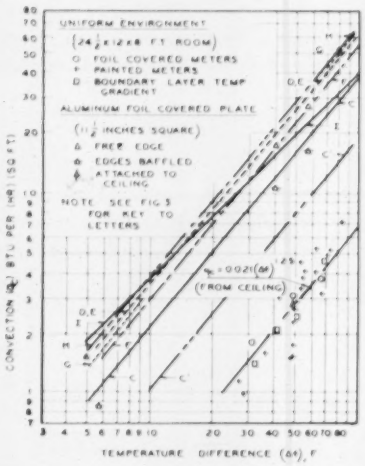

UNIFORM ENVIRONMENT
(24½ x 12 x 8 FT ROOM)
O FOIL COVERED METERS
P PAINTED METERS
D BOUNDARY LAYER TEMP GRADIENT
ALUMINUM FOIL COVERED PLATE
(11½ INCHES SQUARE)
FREE EDGE
EDGES BAFFLED
ATTACHED TO CEILING
NOTE SEE FIG 5 FOR KEY TO LETTERS
$h_c = 0.021(\Delta t)$
(FROM CEILING)
CONVECTION (q) BTU PER (HR) (SQ FT)
TEMPERATURE DIFFERENCE (Δt), F

Fig. 8—Heat Transfer from Heated Ceiling by Natural Convection

Since both the difference method and the direct method were judged to be equally accurate, data obtained by both methods were correlated. In dimensionless form, the correlation was found to be

$$N_{Nu} = 0.071\ (N_{Gr}\ N_{Pr})^{0.35} \quad \ldots\ldots(11)$$

Convection from Heated Ceiling

This relationship is plotted in Fig. 2c, and may be simplified to

$$h_c = 0.041\ [(\Delta t)^{0.25}/D_c^{0.25}] \quad \ldots(12)$$

Convection from Heated Ceiling

Convection heat transfer for a single room size is shown in Fig. 8. Experimental data determined with painted heat-flow meters are also plotted in Fig. 8 but were not used in determining the equation.

The convection coefficient for the walls was determined from the average test values for 3 walls and may be expressed as

$$h_c = 2.17\ [(\Delta t)^{0.08}/H^{0.08}] \quad \ldots\ldots(13)$$

Convection to Walls, Heated Ceiling

The convection data for one room size are plotted in Fig. 4.

In a ceiling-heated room, the temperature difference between the floor and room air was found to be less than 7 F, and the convection to the floor was less than one Btu per (hour) (square foot). This resulted in considerable scatter of the convection values when determined by subtracting the radiation exchange from the observed total heat flow. Another approach was made by plotting the observed total heat flow to the floor against the difference between the floor temperature and the area weighted average temperature of all surfaces excluding the floor. Based on the values of the total heat flow read from a smooth curve drawn through these points, the difference method was then used to get the approximate convection.

The convection values were found to lie between the extrapolated curves for free-edge plates and the convection from the heated ceiling shown in Fig. 8. Probably errors accumulated in the determination of the convection heat flow to the floor are of the same order of magnitude as the convection. Hence, no satisfactory equation has been developed. However, no significant error would result if Equation 12, convection from the heated ceiling, were used for calculating the convection to the floor as long as the range of temperature differences encountered in the tests is not exceeded.

Discussion

Convection, Ceiling Heating: The convection coefficient for the ceiling panel was found to be much smaller than that for a small horizontal heated plate facing downward with edges free, as shown in Figs. 2c and 8. Information concerning the latter has appeared in the literature[11,13-20]. Other investigators[8, 15, 16, 19, 21-23]

predicted that the restriction of air currents at the ceiling of a room would result in lower convection rates.

In order to investigate the effect of boundary conditions on the convection from a horizontal surface, and to verify the low measured value of convection from the ceiling, special tests were made with a horizontal free-edged heated plate 11½ in. square facing downward, suspended at the 60-in. level in the center of the room. The room air temperature was uniform because the floor, ceiling and walls of the room were controlled at one temperature while the small plate was controlled at a higher temperature. The heat flow was measured by a plate-type heat-flow meter cemented to the face of the heated plate. Resulting values of convection agreed well with those of previous investigations as shown in Fig. 8. The edge of the plate was then baffled by a wooden frame 2 in. wide and the convection reduced considerably as shown also in Fig. 8. When the heated plate was attached to and heated to the same temperature as the ceiling, the convection was further reduced. The area weighed value of measurements of several locations is shown in Fig. 8 to lie on the convection curve for the ceiling. In the Environment Laboratory or any actual room, the ceiling is in a sense baffled by the walls. Convection will be affected by this condition.

Convection, Floor Heating: In a floor-heated room with uniform environment the convection heat transfer from the floor panel to the room air was essentially the same as reported by other investigators for a small horizontal heated plate facing upward. The agreement is shown in Figs. 2a and 3.

Wilkes and Peterson's data, curve I of Fig. 3, are somewhat higher than all the other curves. Their data were obtained with large heated and cooled plates spaced only 4 in. apart. This close spacing may account for the difference.

Tests with the small heated plate were also made in the Environment Laboratory. The 11½ in. square heated plate previously described was faced upward and was located first at the 60-in. level and then at the floor level. The results from these tests are also shown in Fig. 3 and agree well with the other data.

The convection transfer from the air to the cooler ceiling in a space heated by a floor panel is shown in Fig. 5, and agrees well with the data of others. It differs only slightly from the data shown in Fig. 3, for heat transfer from a heated floor to cooler air. This slight difference may be attributed to the fact that the room air temperature on which the temperature differences were based was taken at a point 36 in. away from the ceiling but 60 in. away from the floor. Since the walls were at the same temperature as the ceiling but at a lower temperature than the floor, the boundary effects may also have contributed.

Convection, Walls: The values of convection to the walls both with floor heating and ceiling heating agree substantially with the test values for a free-edge vertical plate, as shown in Fig. 4. However the convection to the wall in a ceiling-heated room is a little lower than in a floor-heated room. This may be the result of less air motion in the room or because a higher radiation interchange factor was used when the ceiling is heated. Since all the data for convection to the walls with ceiling heating were taken within a

CONCLUSIONS

The data reported in this paper were obtained with the entire floor area or ceiling area used as a heated panel, a uniform environment wherein all surfaces other than the heated panel were at a uniform temperature, relatively still air conditions (no infiltration), and an empty, unlighted room. Under these conditions the following conclusion may be drawn:

1. On the basis of research done at the ASHAE Laboratory, the following equations apply in calculating natural convection heat transfer at room surfaces.

   A. In a floor-heated space
      1. Convection from floor: $q_c = 0.39\ (\triangle t)^{1.31}/D_e^{0.08}$
      2. Convection to walls: $q_c = 0.29\ (\triangle t)^{1.32}/H^{0.05}$
      3. Convection to ceiling: Same as convection from floor.

   B. In a ceiling-heated space
      1. Convection from ceiling: $q_c = 0.041\ (\triangle t)^{1.25}/D_e^{0.25}$
      2. Convection to walls: Same as for floor-heated space.
      3. Convection to floor: Same as convection from ceiling.

2. Natural convection data given by other investigators for small heated plane surfaces were found to be in good agreement with all of the equations listed in the first conclusion except the equation for natural convection from a heated ceiling. The convection coefficient for small free-edge plates may be 6 to 10 times as great as that for a heated ceiling.

3. Room size in a ceiling-panel-heated room has a significant effect on the unit convection from the ceiling and the floor. However, the convection heat transfer from a heated ceiling is small in comparison with radiation exchange, and therefore, the effect of room size on the total heat transfer is not important. In a floor-heated room, the effect of room size is not significant.

4. In a completely enclosed space with high emissivity room surfaces, the interchange factor between the heated panel and its enclosure may be approximated by the hemispherical emissivity of the panel surface.

5. The approximate combined film conductances (natural convection and radiation) for the heated panels based on the difference between panel temperature and the room air temperature for a normal size room with high emissivity surfaces are as follows:
   $h_{rc} = 2$ for heated floor panel at about 85 F.
   $h_{rc} = 1.1$ for heated ceiling panel at about 120 F.

small range of temperature difference, and scattered considerably. Equation 13 and the slope of the curve in Fig. 4 may be slightly in error.

General: A summary of the information on test apparatus, test conditions, and convection equations for heated surfaces by various authorities is given in Table 1.

It should be noted that the convection values reported here were obtained in the Environment Laboratory under conditions of no infiltration. In an actual panel-heated room, infiltration would cause additional convection. For 1 air change per hour at 0 F in the test room, the convection coefficient increased about 60 percent for the heated ceiling panel at 120 F[1], and increased about 40 percent for the heated floor panel at 85 F[2]. However, the convection coefficients for the walls were not changed appreciably. More definite information will be presented on this subject in another paper.

Characteristic Linear Dimension: Since the data for 3 room sizes correlated well when the equivalent diameter was used in dimensionless Equations 5 and 11 (See Figs 2a and 2c), the characteristic linear dimension was concluded to be the equivalent diameter for the heated floor and ceiling panels. A similar correlation for the convection to the walls, as shown in Fig. 2b, indicated that the characteristic linear dimension of a wall is its height.

The importance of the characteristic dimension in Equation 4 depends upon the exponent of the equation. If the exponent is 1/3, then the characteristic dimension appears on both sides of the equation as $L = (L^4)^{1/3}$ and consequently L cancels, indicating that the convection coefficient is independent of the size of the surface. It will be noted that in floor panel heating (Equation 5), the exponent is nearly 1/3 and the effect of the dimension D_e is very small (see Equation 6). The close agreement of the convection values obtained by other investigators for various sizes of plates as shown in Fig. 4, may be attributed to this fact. In contrast, however, the characteristic dimension is relatively important in determining convection heat transfer from a heated ceiling panel, as shown by Equation 12, since the exponent for this orientation is 1/4 (see Equation 11).

In Equation 7 for wall convection with a heated floor panel, the exponent of 0.32 indicates that the characteristic dimension (wall height) is not important. There is some evidence (Equation 13 and Fig. 4) that the coefficient is considerably different for wall convection with a heated ceiling, and that the wall height in this case may be an important factor. However, over the range of conditions covered in this paper it is suggested that Equation 8 be used for wall convection with either floor or ceiling heating.

Acknowledgment

The authors acknowledge the suggestions and assistance of members of the staff of the ASHAE Research Laboratory and especially the members of the TAC on Panel Heating and Cooling.

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Chapters Regional Committee for Region 2 Meets in Toledo

The Chapters Regional Committee meeting for Region 2 was called to order by Prof. C. H. Pesterfield, Regional Director, in the Secor Hotel, Toledo, Ohio, on Monday morning, April 2, with representatives present from all but one of the 10 Chapters in Region 2. The members and alternates attending were as follows: G. G. Freyder, Illinois; James Jackson, Indiana; E. T. Glanz and P. S. Hosman, Michigan; S. M. Paganelli and F. L. Murray, Western Michigan; J. A. Guy and R. C. Liebert, Central Ohio; A. H. Gerdsen and R. G. Anderson, Cincinnati; H. R. Canoyer and J. A. White, Northern Ohio; C. F. Hoffman and J. J. Heilman, Toledo; L. C. Plaehn, Wisconsin.

Among the 32 registrants for the meeting there were 12 members from Toledo and 12 from Michigan.

After the roll call, C. F. Hoffman, president of the Toledo Chapter, gave a brief welcome to visiting members. Mr. Hoffman was then unanimously elected committee secretary.

P. B. Gordon, first vice president of the Society, was introduced by Professor Pesterfield and spoke on *The Philosophy of the Regional Plan for the Operation of Chapters*. With the aid of slides he described the origin of the plan and explained the objectives of the Society and the operation of the Chapters Regional Committees in the 7 regions as well as the functions of the Regions Central Committee composed of the 7 regional directors. He devoted a brief time to a discussion of the chapters' agenda.

C. H. Pesterfield, regional director, calling to order the Chapters Regional Committee Meeting for Region 2

(l. to r.) L. C. Plaehn, Milwaukee; Pres. John W. James, Chicago; and C. F. Hoffman, Toledo

Professor Pesterfield invited the members present to propose subjects for discussion which could be placed on the chapters' agenda and this brought forth many suggestions which were thoroughly discussed before the luncheon period.

Following the luncheon President Hoffman of the Toledo Chapter introduced John W. James, president of the Society, who gave a brief talk on *Our Society and Its Future*, which was of interest to the 40 present.

A member and two alternate members to serve on the Nominating Committee for 1957 were elected in executive session.

Professor Pesterfield called for a discussion of chapter problems including membership, speakers, programming, attendance, meals, publicity, meeting announcements, and dues.

Chapters Regional Committee meeting was arranged under the direction of Regional Director C. H. Pesterfield, East Lansing, with the assistance of C. F. Hoffman and a Toledo Chapter committee composed of F. C. Richardson, Jr., J. F. Guest, J. S. Meyer, M. D. Williams, J. J. Heilman and R. K. Swab.

(Left) Luncheon during Chapters Regional Committee Meeting (l. to r.) P. B. Gordon, New York, N.Y.; F. C. Richardson, Jr., Toledo; President James; C. F. Hoffman, Toledo; C. H. Pesterfield, E. Lansing, Mich.; E. R. Queer, University Park, Pa.; J. J. Heilman, Toledo. (Right) Members and alternate members attending the Chapters Regional Committee Meeting for Region 2 held at Toledo, April 2, 1956

Send In Those Reservations For Semi-Annual Meeting

In a few short weeks the Semi-Annual Meeting 1956 of the Society will convene June 18, 19, 20 at Washington, D. C. with President John W. James presiding. Although the response has been good, the Committee on Arrangements believes there are still more reservations which have not yet been returned. For your own convenience, you are urged to take care of this promptly.

P. R. Achenbach, general chairman of the Committee on Arrangements, wishes to point out that the sightseeing boat trip to Mt. Vernon and return by bus with a stop-off at Arlington Cemetery and Ft. Myer is not only for the ladies and children, but all men who are otherwise unengaged on Tuesday afternoon are invited to make this sightseeing trip.

The Committee originally hoped that it would be possible to provide a conducted tour of the White House for the ladies and children on Tuesday morning. However, they have found out this is not possible, but visitors are welcomed at the White House on Tuesday and Wednesday from 10:00 a.m. until noon. The Capitol can not be visited until after noon.

The Program and Papers Committee under the chairmanship of W. A. Grant announces that the following members will serve as vice chairmen of the various sessions: Second Session — L. G. Miller; Third Session — R. S. Dill; Fourth Session — W. F. Friend; Fifth Session — T. H. Urdahl; Sixth Session — W. A. Grant; and Seventh Session — P. B. Gordon.

The Standards and Codes Symposium which will be moderated on Wednesday morning by Prof. C. H. Pesterfield will be comprised of the following: Standards and Codes in General — J. C. Fitts; Protective Standards — Cyril Ainsworth; Governmental Aspects — R. S. Dill; Local & Municipal Standards & Codes — John W. James, Commercial-Industrial Standards — G. S. Jones; and Establishment of Standards & Codes through Experimentation — L. N. Hunter.

As mentioned in previous reports the Semi-Annual Meeting will include the presentation of 14 papers and the convening of 2 symposiums; will be divided into 7 sessions with one on Monday morning, 2 on Tuesday morning, 2 on Wednesday morning and 2 sessions on Wednesday afternoon.

Between the Program and Papers Committee and the Committee on Arrangements, an excellent program of events has been planned for all those attending the Semi-Annual Meeting. Among the special events planned by the members of the Washington Chapter there is a reception on Sunday evening, a Get-Together Party on Monday evening and, of course, the Semi-Annual Banquet which will conclude the meeting on Wednesday evening. Following the Welcome Luncheon on Monday, the Annual ASHAE Golf Tournament for the Past Presidents' Research Bowl, Eichberg Memorial Cup and the Paul Bunyan Trophy will take place at the Congressional Country Club.

The Semi-Annual Meeting in Washington, D. C., will provide an opportunity for a wonderful family vacation as well as offer an opportunity to attend some of the finest sessions ever planned by the Society. Remember you have a date and mail in those reservations promptly.

Transportation Rates* To Washington, D. C. From Chapter Cities

City	1st Class Round Trip By Rail	One Way Roomette	Round Trip By Air	City	1st Class Round Trip By Rail	One Way Roomette	Round Trip By Air
Albany, N.Y.	$ 32.20	$ 14.00	$ 43.40	Lubbock, Tex.	119.40	20.50	172.20
Albuquerque, N.M.	134.10	28.25	205.20	Memphis, Tenn.	67.40	15.90	95.90
Atlanta, Ga.	44.40	10.60	71.70	Milwaukee, Wis.	70.55	12.50	76.60
Austin, Tex.	107.30	22.45	170.70	Minneapolis, Minn.	89.30	16.25	108.00
Baltimore, Md.	3.46	.91	6.70	Montreal, Canada	51.40	9.15	70.40
Baton Rouge, La.	79.05	20.70	129.20	New Orleans, La.	79.05	16.25	121.60
Boston, Mass.	40.76	8.20	48.60	New York, N.Y.	20.10	5.00	27.40
Buffalo, N.Y.	56.45	14.00	43.40	Norfolk, Va.	15.78	7.00	18.40
Charlotte, N.C.	26.40	7.00	44.50	Oklahoma City, Okla.	96.10	19.70	142.60
Chicago, Ill.	65.55	11.55	71.90	Omaha, Neb.	94.60	17.10	122.50
Cincinnati, Ohio	47.35	8.20	50.40	Ottawa, Canada	59.40	14.00	69.20
Cleveland, Ohio	37.25	7.00	39.60	Philadelphia, Pa.	12.02	1.82	16.30
Columbus, Ohio	41.95	8.20	41.60	Phoenix, Ariz.	165.95	33.50	247.80
Dallas, Tex.	96.65	20.25	148.40	Pittsburgh, Pa.	26.40	7.00	24.90
Dayton, Ohio	48.20	8.20	50.40	Portland, Ore.	180.55	39.10	285.80
Denver, Colo.	125.95	25.50	180.40	Sacramento, Calif.	187.05	38.20	285.80
Des Moines, Ia.	86.45	16.25	180.10	St. Louis, Mo.	76.85	12.50	88.20
Detroit, Mich.	50.60	9.15	51.90	Salt Lake City, Utah	152.65	29.40	231.80
Edmonton, Canada	164.50	34.05	265.40	San Francisco, Calif.	187.05	38.20	285.80
Grand Rapids, Mich.	65.75	9.15	71.20	Seattle, Wash.	180.55	39.10	285.80
Greensboro, N.C.	19.80	7.00	34.90	Shreveport, La.	85.65	17.60	132.90
Greenville, S.C.	33.75	8.20	34.60	Spokane, Wash.	162.60	34.95	265.10
Hartford, Conn.	29.92	7.65	38.20	Springfield, Mass.	32.20	8.20	38.20
Houston, Tex.	102.90	20.25	159.60	Syracuse, N.Y.	43.90	14.00	57.00
Indianapolis, Ind.	56.75	10.60	62.90	Toledo, Ohio	45.80	9.15	47.60
Jackson, Miss.	71.90	15.55	110.90	Toronto, Canada	45.75	8.20	68.20
Kansas City, Mo.	92.35	16.25	115.10	Tulsa, Okla.	93.35	18.45	129.60
Little Rock, Ark.	76.85	15.55	111.20	Vancouver, Canada	180.55	40.50	298.90
Los Angeles, Calif.	187.05	38.20	285.80	Wichita, Kan.	96.10	19.30	137.30
Louisville, Ky.	53.95	10.60	59.20	Winnipeg, Canada	114.35	24.05	159.20

*Do not include 10% Federal tax.

Program Semi-Annual Meeting 1956

American Society of Heating and Air-Conditioning Engineers

June 18-20, 1956

The Shoreham — **Washington, D.C.** — **The Sheraton-Park Hotel**

All meetings and events at The Shoreham unless otherwise designated

Monday — June 18

9:00 a.m. REGISTRATION (*Main Lobby*)

9:30 a.m. FIRST SESSION (*West Ballroom*)
Call to Order — Pres. John W. James

Greetings by P. R. Achenbach, Chairman, Committee on Arrangements
Comparative Performance of Indirect Water Heaters, by L. L. Hill and W. S. Harris
Natural Convection and Radiation In A Panel-Heated Room, by T. C. Min, L. F. Schutrum, G. V. Parmelee and John Vouris

9:30 a.m. Ladies' Sightseeing Trip to Federal Bureau of Investigation

12:00 p.m. WELCOME LUNCHEON (*Blue Room*)
Toastmaster: Gen. W. A. Danielson
Speaker: Brig. Gen. Thomas A. Lane, Engineer Commissioner, Dist. of Columbia

1:00 p.m. Golf Tournament (*Congressional Country Club*)

1:00 p.m. Inspection Trip — David Taylor Model Basin

2:30 p.m. Ladies' Sightseeing Trip to Pakistan Embassy and Islamic Center

7:30 p.m. Get-Together Party (*Shoreham Terrace*)

Tuesday — June 19

9:00 a.m. REGISTRATION (*Main Lobby*)

9:30 a.m. SECOND SESSION (*Main Ballroom*)
Call to Order — Vice Pres. P. B. Gordon

Vice Chairman, L. G. Miller

Heat Requirements of Snow Melting Systems, by W. P. Chapman and Samuel Katunich
Small-Pipe Perimeter Heating In A Residence, by D. R. Bahnfleth, H. T. Gilkey and C. F. Chen
Heat Load Calculations by Thermal Response, by W. R. Brisken and S. G. Reque

9:30 a.m. THIRD SESSION (*West Ballroom*)
Call to Order — Vice Pres. E. R. Queer

Vice Chairman, R. S. Dill

Air Velocities In Two Parallel Ventilating Jets, by Alfred Koestel and J. B. Austin, Jr.
Dependence of Water Vapor Permeability On Temperature and Humidity, by S. C. Chang and N. B. Hutcheon
Effect of Unbalanced Air Pressure on Permeance, by F. A. Joy and D. R. Fairbanks

9:30 a.m. Ladies' Visit to White House and Capitol

12:00 noon Inspection Trips (Buses leave between 12:00 and 12:30 p.m. Cafeteria service available on arrival):
(*a*) Naval Ordnance Laboratory
(*b*) National Institute of Health

1:00 p.m. Sightseeing Trip to Mt. Vernon (*Boat and Bus*)

Wednesday — June 20

9:00 a.m. REGISTRATION (*Main Lobby*)

9:30 a.m. FOURTH SESSION (*Main Ballroom*)
Call to Order — Pres. John W. James

Vice Chairman, W. F. Friend

Laboratory For Solar Energy Study at Minnesota, by R. C. Jordan and J. L. Threlkeld
Intermittent Ground Grids For Heat Pumps, by G. S. Smith
Intermittent Heating and Cooling of Buildings, by P. L. Pfennigwerth and Merl Baker

9:30 a.m. FIFTH SESSION (*West Ballroom*)
Call to Order — Vice Pres. P. B. Gordon

Vice Chairman, T. H. Urdahl

Standards and Codes Symposium
C. H. Pesterfield, Moderator
Standards and Codes in General — J. S. Fitts
Protective Standards — Cyril Ainsworth
Governmental Aspects — R. S. Dill
Local and Municipal Standards and Codes — John W. James
Commercial-Industrial Standards — G. S. Jones
Establishment of Standards and Codes through Experimentation — L. N. Hunter

12:30 p.m. Ladies' Luncheon and Fashion Show (*Sheraton Park Hotel*)

2:00 p.m. SIXTH SESSION (*Main Ballroom*)
Call to Order — Vice Pres. E. R. Queer

Vice Chairman, W. A. Grant

Symposium on Residential Air Conditioning
L. H. Haeger, Moderator
Combination Fuel Operated Systems — W. E. Hood
Fuel Operated All-Year Systems — A. B. Newton
Electrically Operated Systems — E. R. Ambrose
Future System Developments — W. F. Friend
Performance of Systems — W. H. Scott

2:00 p.m. SEVENTH SESSION (*West Ballroom*)
Call to Order — Pres. John W. James

Vice Chairman, P. B. Gordon

Performance of One-Row Tube Coils With Thin Plate Fins, Low Velocity Forced Convection, by D. G. Shepherd
Temperature and Humidity Effect on Odor Perception, by W. F. Kerka and C. M. Humphreys
The Indirect Evaporative Air Cooler, by J. R. Watt and R. A. Bacon
Report of Resolutions Committee
Unfinished Business
New Business
Adjournment

6:30 p.m. Social Hour (*West Ballroom*)

7:00 p.m. SEMI-ANNUAL BANQUET (*Terrace Banquet Room*)
Presentation of Honorary Membership Certificates, Past Presidents Memory Book and Golf Trophies

P. R. Achenbach
General Chairman

W. A. Danielson
Honorary Chairman

W. C. Reamy
Vice Chairman

Committee on Arrangements

SEMI-ANNUAL MEETING

June 18-20, 1956

Washington, D. C.

J. G. Muirhead, Chairman
Reception

J. W. Morgan, Chairman
Children

J. H. Broome, Chairman
Entertainment

S. Rushmore Allen,
Chairman Transportation

A. S. Gates, Jr., Chairman
Finance

F. E. McArdle, Chairman
Sports

P. R. Achenbach
General Chairman

W. A. Danielson
Honorary Chairman

W. C. Reamy
Vice Chairman

Reception: J. G. Muirheid, Chairman; W. J. Caldwell, R. S. Dill, G. S. Frankel, R. A. Grant, H. H. Hill, L. G. Humphrey, Jr., W. C. Jones, W. E. Kingswell.

Entertainment: J. H. Broome, Chairman; T. F. Burke, A. C. Crawford, J. H. Dale, H. E. Grossman, P. B. Holmes, H. W. Hottel, H. W. Rush, G. R. Walz.

Finance: A. S. Gates, Jr., Chairman; G. W. Campbell, W. H. Littleford, J. J. Nolan, Jr., W. C. Reamy, Glenn Thomas.

Ladies: Mrs. J. H. Broome, Chairman; Mmes. P. R. Achenbach, G. C. F. Asker, A. C. Crawford, H. E. Grossman, P. B. Holmes, H. W. Hottel, John W. James, R. C. McMann, J. G. Muirheid, E. F. O'Connell, W. C. Reamy, W. T. Smith.

Publicity: B. P. Evans, Chairman; I. M. Day, W. H. Hobbes, Jr., F. E. McArdle, L. D. Pain.

Banquet: F. A. Leser, Chairman; A. E. Beitzell, G. W. Campbell, H. G. Carlton, S. P. Eagleton, P. H. Nonar, T. H. Urdahl.

Sessions: G. C. F. Asker, Chairman; J. W. Alexander, H. G. Carleton, J. J. Chaconas, Sr., C. W. Coblentz, I. M. Day, L. H. Holder, S. A. Heider, C. P. Humke, J. S. King, P. H. Loughran, R. C. McMann, J. J. Nolan, Jr., G. E. A. Siggelin.

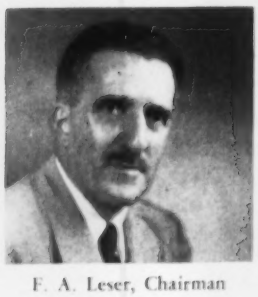
Sports: F. E. McArdle, Chairman; T. F. Burke, P. B. Holmes, H. W. Hottel, W. E. Kingswell, E. F. O'Connell.

Transportation: S. R. Allen, Chairman; A. C. Crawford, L. T. Davis, E. B. Ferguson, G. W. Gault, C. W. Holliday, S. H. Robbins, Jr.

Children: J. W. Morgan, Chairman; J. A. Chappelear, C. W. Holliday, L. G. Humphrey, Jr., W. V. McCoy, L. D. Pain, R. B. Rus

Mrs. J. H. Broome,
Chairman Ladies

B. P. Evans, Chairman
Publicity



F. A. Leser, Chairman
Banquet

G. C. F. Asker, Chairman
Sessions

Chapters Regional Committee Meeting Held in Toronto

Pictures taken at Region 7 Chapters Regional Committee Meeting. Left Photo (l. to r.) front: C. A. Torry, P. M. Butler, E. K. Cumming; Center: H. G. S. Murray, W. J. Robinson, A. H. Millar; Standing: H. R. Roth, Pres. John W. James, 2nd Vice Pres. E. R. Queer, B. W. Farnes, J. H. Ross, Cornelius Van Boeyen. Right Photo. Front: C. A. Torry, P. M. Butler, E. K. Cumming. Back: H. G. S. Murray, W. J. Robinson, A. H. Millar, H. R. Roth

The fifth Chapters Regional Committee meeting was held Monday, April 9, at the Royal York Hotel in Toronto, Ont., Canada, with Regional Director J. H. Fox, Toronto, presiding. The various chapters comprising Region 7 were represented as follows: Cornelius Van Boeyen, British Columbia; A. H. Millar, Manitoba; H. G. S. Murray and alternate D. L. Lindsay, Montreal; C. J. Bootes and alternate Charles Torry, Ontario; W. J. Robinson and alternate E. J. Schoenherr, Ottawa Valley; P. M. Butler and alternate E. K. Cumming, Northern Alberta.

The Society was represented by Pres. John W. James, Chicago, Ill.; First Vice Pres. P. B. Gordon, New York, N.Y.; Second Vice Pres. E. R. Queer, University Park, Pa., and the following members of Council: John E. Haines, Minneapolis, Minn.; J. H. Ross, Toronto, Canada; B. W. Farnes, Portland, Ore.; J. N. Livermore, Detroit, Mich.; John Everetts, Jr., Philadelphia, Pa.; and A. B. Algren, Minneapolis, Minn. The first order of business was the election of a committee secretary, and C. J. Bootes, vice president of the Ontario Chapter, was unanimously elected to this office.

The committee then was addressed by President James, who discussed *Our Society and Its Future*, detailing the development of the Society's research efforts since 1919 culminating with the establishment of the Research Laboratory in Cleveland in 1946 and its subsequent progress.

He likewise detailed the development of the Society's publications and, in looking to the future, indicated that the activities of the Society will continue to expand in relation to the steady increase of members and chapter growth.

In presenting the *Philosophy of the Regional Plan of Chapter Operations*, First Vice Pres. P. B. Gordon explained how this began in 1947 and evolved through 8 years of work by various committees with the final Regional Plan becoming effective under the new By-Laws of the Society on January 25, 1956. In his discussion he stated the Society's objectives, explained the mechanisms that permit it to accomplish its purposes and gave a detailed analysis of the Regional Plan of Chapter Operations.

C. J. Bootes and J. H. Fox at Chapters Regional Committee Meeting for Region 7 held in Toronto, April 9

Information on maintaining chapter records and minutes was provided by Executive Secy. A. V. Hutchinson, New York, N.Y., who also answered questions posed by the delegates regarding membership, upgrading of members and more effective dues notices.

In the dual capacity of chairman of the Society's Public Relations Committee and regional director, Mr. Fox discussed chapter publicity and publications, pointing out some methods for securing local publicity.

Discussing chapter operations, various members of the committee compared their respective methods of handling dues, finances, meeting places, meals and attendance.

An invitation was extended by the Ottawa Valley Chapter to hold the 1957 meeting of Region 7 in Ottawa, and this will be referred to the Regions Central Committee by Regional Director Fox.

The all-day meeting was held at the Engineers' Club of Toronto, and following adjournment members of the committee, Society officers and Council members joined the Ontario Chapter members for dinner and the regular monthly chapter meeting at the Royal York Hotel.

Second Vice Pres. E. R. Queer was the featured speaker, and he presented an evaluation of the Chapters Regional Committee Meetings which have been held so far.

REGIONS CENTRAL COMMITTEE HOLDS QUARTERLY MEETING

The first quarterly meeting of the Regions Central Committee was held April 7, 1956 in the Royal York Hotel, Toronto, Ont., Canada, under the chairmanship of Second Vice Pres. E. R. Queer, University Park, Pa.

In attendance were the following regional directors: John Everetts, Jr.,

Region 1; John E. Haines, Region 3; A. J. Hess, Region 4; and J. H. Fox, Region 7.

Also present by invitation of the committee were Pres. John W. James, Chicago, Ill.; First Vice Pres. P. B. Gordon, New York, N.Y.; Treas. R. A. Sherman, Columbus, O.; and Council members B. W. Farnes, Portland, Ore., and J. H. Ross, Toronto, Ont., Canada.

Mr. Everetts was unanimously elected committee secretary. The meeting was devoted primarily to a discussion and review of the Chapters Regional Committee meetings held thus far and an analysis of the effectiveness of the meetings.

The Regions Central Committee will meet again at the time of the Semi-Annual Meeting 1956 in Washington, D.C. in June.

Summary of Chapter Meetings*

• *ARIZONA*: A report on the Society's Annual Meeting held in Cincinnati was given in February by Pres. W. A. Biddle.

The Chapter elected E. P. Boothroyd as its nominee for the Engineer of the Year. Mr. Boothroyd was also elected to the nominating committee together with J. L. Taylor and H. G. Angerman. Attendance 23. Attendance ratio 0.33.

• *ARKANSAS*: An Arkansas Chapter member, Fred Tenny, district manager, Johnson Service Co., Little Rock, Ark., was the speaker at the February meeting. Following his introduction by Pres. J. L. Brown, Mr. Tenny gave a comprehensive history of controls for heating and air-conditioning systems. He explained that controls were originally developed from hydraulic or pneumatic brakes and first used as heating controls about 1890 to 1900. Mixing dampers and fresh air were the next step. After electricity came into general use, electric controls were also developed. Pneumatic and electric controls have undergone constant improvement. Mr. Tenny concluded by stating that with the addition of year-round air conditioning, controls are even more important and much more complex than the original simple designs.

Engine-airs was the name selected for the new chapter publication. The name, which was one of 15 suggestions, had been submitted by E. C. Dean. Attendance 24.

• *ATLANTA*: At a joint ASHAE-*ASRE* meeting held in February R. L. Bernhart, manager, Centrifugal Compressor Division, American Blower Corp., Detroit, Mich., spoke on a new refrigeration machine. T. A. Barrow, Jr., president of the Atlanta Chapter of the Society, presided. Attendance 119. Attendance ratio 0.44.

• *BATON ROUGE*: Secy. A. J. Mayers, Jr., announced in February that a telegram of congratulations had been sent to the Northern Alberta Chapter, the latest chapter to be chartered. Pres. C. S. Woodruff gave a few highlights of the 1956 Annual Meeting, outlining the coverage of the papers presented. President Woodruff also reported that he had been selected by the officers and board of governors as alternate member of the Chapters Regional Committee, with J. F. Naylor, Jr., as member.

Types of Fan Fundamentals was the subject discussed by E. A. Rehn, district sales manager, Clarage Fan Co., Atlanta, Ga., who was presented to the audience by W. J. LeBlanc. Attendance 33. Attendance ratio 0.53.

• *BLUEGRASS*: At the meeting in February presided over by Vice Pres. W. J. Killian, a short talk on gas supply, current consumption in Louisville, and new regulations on residential air-conditioning installation was given by L. G. Dohl, vice president, Louisville Gas and Electric Co.

The main speaker, G. F. Landgraf, vice president, engineering, Trion, Inc., McKees Rocks, Pa., was introduced by S. S. Emison. In his talk entitled *Evaluation of Air-Cleaning Equipment*, Mr. Landgraf described methods employed in evaluating air-filtering devices and discussed current contamination studies.

• *BRITISH COLUMBIA*: C. W. Leek introduced the February guest speaker, Donald Denham, chief boiler inspector for the Provincial Government. His subject was *The Relationship of the Boiler Inspection Act to Industrial Development*. Mr. Denham traced the progress in boiler design and inspection standards since the act was drafted in 1899. He noted that the act was modified in 1932 to include modern welding techniques. Since 1946, the speaker explained, hot-water heating boilers and systems have been subject to inspection by the Provincial Government, and in more recent years certain phases of refrigeration are inspected. An expression of appreciation was given to Mr. Denham by R. B. McDonell for the timely and informative address.

Secy. A. C. Martin was authorized to send a telegram of congratulations to the Northern Alberta Chapter. D. W. Thomson, member, Chapters Conference Committee, gave a detailed report on the 1956 Annual Meeting, outlining specific business items which were of special interest to the chapter. Attendance 49. Attendance ratio 0.53.

• *CENTRAL NEW YORK*: *Atomic Energy—Its Present-Day Application to Heating and Air Conditioning* was the topic covered by B. S. Tucker, head of the atomic energy program, C. H. Wheeler Manufacturing Co., Philadelphia, Pa. All questions submitted following the talk were promptly answered by Mr. Tucker. Pres. L. A. Childs thanked Mr. Tucker for his educational and enlightening talk. H. K. Ormsby, Jr., had introduced the speaker.

President Childs reported on the 1956 Annual Meeting and explained the new Regional Plan. Attendance 56. Attendance ratio 0.30.

• *CENTRAL OHIO*: The meeting co-chairman introduced the February speaker, William Alfey, mechanical engineer, Aircraft and Automotive Division, Surface Combustion Corp., Columbus, Ohio. He delivered a talk on *Heating and Ventilating of Modern Aircraft*, which proved to be of great interest.

Pres. R. A. Wilson reported on the meeting of the Chapters Conference Committee held in Cincinnati. Attendance 31. Attendance ratio 0.20.

• *CINCINNATI*: Additional letters of commendation of the 1956 Annual Meeting held in Cincinnati were read at the March chapter meeting by Pres. A. H. Gerdsen. President Gerdsen named E. W. McNamee and H. E. Russell to the Nominating Committee, with R. C. Beinecke as chairman. He also appointed an auditing committee, consisting of W. H. Junker, J. J. Bubser and G. B. Houliston.

Various phases of zone heating controls and the application of outdoor controls to such systems were discussed by H. T. Kucera, president, Automatic Devices Co., Inc., Western Springs, Ill. His topic was *Control of Building Heating from Outdoors*.

Secy. T. D. Reiley reported that a telegram of congratulations had been sent to the Northern Alberta Chapter. Attendance 39. Attendance ratio 0.28.

• *CINCINNATI*: An excellent talk entitled *Atomic Energy Illustrated* was given in February by Dr. Simon Kinsman, associate chief of training, Sanitary Engineering Center, Public Health Service. Dr. Kinsman spoke on atomic contamination detection, and certain phases of the manufacture and use of atomic energy.

A brief report on the progress of the newly organized committee for the study of Chimney Requirements in Cincinnati was made by W. H. Junker. A. W. Edwards, E. W. McNamee, C. P. Krantz and A. H. Gerdsen read complimentary letters and reported regarding the success of the Society's Annual Meeting held in Cincinnati in January. It was felt that the entire membership and their wives were to be congratulated for the fine job which was done. Attendance 28.

*Note: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

• *CONNECTICUT*: Fritz Hornerkamp introduced the January speaker, A. J. Hess, member of Council and consulting engineer, Hess-Greiner & Polland, Los Angeles, Calif. Mr. Hess spoke on panel cooling. He reviewed its history, discussed methods of design and application, and enumerated its advantages and disadvantages in comparison with other types of air-conditioning systems. Pres. E. J. Hoagland presided.

• *DELTA*: *Trials, Tribulations and Triumphants*—describing the growth of the Delta Chapter—was the title of a program presented at the February meeting. Walter Cooke was chairman of the committee on arrangements for this program, which featured reminiscences by each attending past president of the chapter on the highlights of his term in office. To climax the proceedings C. V. Bankston, immediate past president, was inducted into the Royal Order of the AOPP and was presented a past president's certificate by Pres. W. B. Martin, Jr.

E. H. Sanford introduced the speaker of the evening, Thomas Cranage, district sales manager, Clarage Fan Co., Chicago, Ill. The subject of his talk was *Characteristics and Applications of the Fundamental Type of Fans*. Attendance 64.

• *EMPIRE STATE CAPITAL*: H. E. Voegeli, development engineer, The American Brass Co., Waterbury, Conn., discussed problems, experiments and possibilities in connection with *Stored Solar Heat and The Heat Pump* at the February meeting.

Pres. L. V. Appleby gave a resume of the 1956 Annual Meeting held in Cincinnati and appointed a nominating committee for the election of officers for 1956-57. The committee members are as follows: A. L. Becker, as chairman, L. W. LaPlante, D. H. Gregory, F. R. Foote and B. E. Mullen. Attendance 28. Attendance ratio 0.38.

• *ILLINOIS*: Society Pres. John W. James, Chicago, Ill., was introduced at the February meeting by G. G. Freyder, president of the Illinois Chapter, and spoke briefly to the members. Life Membership certificates were presented by E. P. Heckel, Sr., to J. J. Hayes and by C. W. Deland to E. W. Rietz.

A talk on the *Application of Absorption Refrigeration Systems* was given by J. O. Yund, chief application engineer, Servel, Inc., Evansville, Ind. By means of slides, Mr. Yund illustrated while describing the complete cycle and theory of the absorption system. He also outlined its operation and limitations. Attendance 141.

• *INDIANA*: Pres. J. W. Jackson introduced the February speaker, Bob Kryter, who gave an excellent talk on the use of atomic power, both for peace and war. Mr. Kryter covered 4 phases of the general topic: weapons, useful power, use of radioactive material and fundamental research. Attendance 37.

• *INDIANA*: A building of unusual design was the subject of discussion at the January meeting. W. L. Kercheval introduced the guest speaker, T. R. Davis, consulting engineer, Ammerman-Davis & Stout, Inc., Indianapolis, Ind. Mr. Kercheval described the equipment design of the Student Union & Food Service Building, Indiana University Medical Center, which runs the gamut for heating, ventilating, air conditioning and refrigeration design. The speaker explained the developing need for this type of building, which includes a cafeteria, restaurant, hotel accommodations, apartments, recreational areas, and an indoor swimming pool. The growing enrollment required facilities for the students for living, recreation and meetings, as well as a central food preparation and handling facility, all of which were incorporated into this same building. Following adjournment of the meeting, Mr. Davis conducted an inspection tour of the building, explaining the mechanical equipment installation.

During the business section of the meeting, a plaque was presented to A. B. Keller for his outstanding contribution to the chapter in the past year by continually publishing the best monthly news-bulletin in chapter history. Pres. J. W. Jackson discussed the new regional plan of the Society. Attendance 27.

• *INLAND EMPIRE*: An extensive report on his trip to the 1956 Annual Meeting was given by R. B. Campbell, member, Chapters Conference Committee, at the chapter meeting in February.

Participating in the program for the evening were Kenneth Brooks, architect, and K. M. Woods, mechanical consulting engineer. They discussed architect and engineer relationships in construction work. Pres. F. W. Jenkinson was the presiding officer.

• *IOWA*: *Liquid Air Conditioning Systems* were discussed in a speech by C. A. McKeeman, supervisor, Heating and Cooling School, American Radiator and Standard Sanitary Corp., Buffalo, N.Y., at the February meeting. Following his introduction by D. E. Schroeder, Mr. McKeeman described the advantages of a remote chiller and multiple units composed of fan, filter, and water coil for cooling and heating over a central duct system. He listed these advantages as space saving, individual room control, separation of air in the areas served, and privacy. Mr. McKeeman felt that the advantages prevailed for a perimeter system of small divided spaces. Where large interior areas were involved, the necessity of introducing ventilation air placed the advantage with the central systems using low pressure air. The speaker placed emphasis on the dangers of oversizing of units and the chances of failure of the system through inability to control humidity.

C. A. McKeeman
Buffalo, N.Y.

Pres. G. J. Kraai announced the Chapters Regional Committee Meeting to be held in Omaha, Neb., on May 8. Attendance 59. Attendance ratio 0.46.

• *IOWA*: Statistics on *The Engineering Shortage and the Heating and Air-Conditioning Industry* were given by Prof. L. R. Hillyard, engineering personnel officer, Iowa State College, Ames, Ia., in January. D. E. Schroeder introduced Professor Hillyard, who indicated that engineering graduates at Iowa State College had increased from a prewar average of 260 to 863 in 1950, then dropped to 269 in 1954. Professor Hillyard said that it is expected that there will be 400 graduates in 1956.

D. E. Wells reported the illness of W. E. Burch, and Secy. W. A. Schworm was authorized to send a letter and flowers. Attendance 35.

• *KANSAS*: The subject selected by the February speaker, J. L. Hoyer, national products manager, air conditioning, Rheem Manufacturing Co., Chicago, Ill., was *Residential Air Conditioning: A New Low in Initial and Operating Costs*.

Vice Pres. H. M. Skalla, member, Chapters Conference Committee, reviewed his attendance at the 1956 Annual Meeting of the Society. Attendance 31.

• *KANSAS*: *Refrigeration Piping Problems* was the subject chosen by the January guest speaker, J. H. Erb, district chief engineer, Carrier Corp., Chicago, Ill. Vice Pres. H. M. Skalla introduced the speaker.

Vice President Skalla was appointed to the Kansas State College Planning Committee for Air Conditioning. Pres. A. B. Newton presided at the meeting. Attendance 45.

• *KANSAS CITY*: An enlightening discussion on motor protection for air-conditioning equipment was given in February by D. O. Smith, Fusetron Division, Bussman Manufacturing Co., St. Louis, Mo. Mr. Smith demonstrated actual equipment. The talk was well received and brought forth a lively question and answer period.

Reports on the 1956 Annual Meeting were given by D. M. Allen, who spoke on the activities of the Kansas City group; R. M. Spencer, who covered the proceedings of the Chapters Conference Committee; and E. K. Campbell, who told of a meeting of Life Members.

R. W. Tobey announced observance of National Engineers Week. J. C. Fasnacht reported on the activities of the vocational guidance committee in an advisory capacity with Kansas State College and their

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projected air-conditioning conference. Attendance 75. Attendance ratio 0.27.

• *MANITOBA*: H. R. Skinner introduced the speaker at the February meeting, C. B. Ashenfelter, sales engineer, Johnson Service Co., Minneapolis, Minn. Mr. Ashenfelter gave an interesting talk on *Temperature Control* and answered a number of questions asked by the members. D. S. Swain thanked the speaker for his talk and for coming up from Minneapolis to address the meeting.

Pres. G. C. Davis gave a complete report on the 1956 Annual Meeting and the new regional plan. The president appointed A. H. Millar to serve as a member on the Chapters Regional Committee. A telegram of congratulations sent to Northern Alberta Chapter was read by President Davis.

The President announced that Vice Pres. A. J. McIntyre would be moving to Ontario and stated that the absence of this active member would be felt by the Manitoba Chapter. Vice President McIntyre expressed his regret in leaving Winnipeg and his many friends in the Chapter. Attendance 37.

• *MANITOBA*: Since Pres. G. C. Davis was in attendance at the Society's 1956 Annual Meeting, Vice Pres. A. J. McIntyre took the chair at the January meeting of the chapter.

R. M. Fraser introduced the speaker, D. Wiley, Marley Canadian Limited, who gave a highly informative talk on *Cooling Towers*. D. S. Swain expressed the chapter's appreciation to the speaker. Attendance 29.

• *MASSACHUSETTS*: The application of *Nuclear Energy for Space Heating* was the subject of the presentation in February by A. I. Brayman, Charles T. Main, Inc., Boston, Mass. W. G. Martin, Jr., introduced the speaker.

Pres. G. D. Fife delivered a report on the 1956 Annual Meeting. Secy. R. F. Curry read the report of the nominating committee. Attendance 96. Attendance ratio 0.29.

• *MASSACHUSETTS*: Despite a howling snowstorm on the night of the January meeting which forced some 25 members to cancel their reservations, the Massachusetts Chapter had its largest attendance record that night. This was attributed to the excellence of the speakers and to the fortitude of those attending.

The speakers, L. J. Crowley, consulting engineer, Boston, Mass., and Ray Borden, were introduced by W. G. Martin, Jr. An audience of 56 members and 40 guests heard an interesting illustrated lecture on the application of a chilled water air-conditioning system in the Pathology Building at Massachusetts General Hospital.

Pres. G. D. Fife discussed the aims and objectives of the 1956 Annual Meeting and described the operation of the then proposed Regional Plan. A motion was carried that John Bonner and D. W. Noble serve on the nominating committee. Attendance 96. Attendance ratio 0.32.

• *MEMPHIS*: Pres. John Hilton, II, presided at the February meeting at which approval was given for a congratulatory telegram to be sent to Northern Alberta Chapter and a letter of thanks to the Engineer's Club for their invitation to their meeting in honor of Engineers' Week.

W. L. Henson was appointed as member of the Chapters Regional Committee, with R. H. Bolding as alternate member. Mr. Henson reported on the 1956 Annual Meeting, covering the business of the meeting and the changes involved in following the new Regional Plan. Attendance 12. Attendance ratio 0.20.

• *MIAMI VALLEY*: A panel discussion on plans and specifications, with Vice Pres. J. B. Rishel acting as moderator, was held at the January meeting. The members of the panel were J. M. Schweiger, representing the consulting engineer; C. D. Weaver, Jr., the salesman; and J. J. Bechtol, the contractor. A lively discussion and a question-and-answer period followed.

J. R. Ahart, who was appointed by Gov. F. J. Lausche, of the State of Ohio, to the board of building standards, told of the operation of this board and its aims. Attendance 65.

• *MICHIGAN*: Consideration of *What the Owner Thinks about Heating and Air Conditioning* was given by J. N. Livermore, assistant director, design engineering department, The Detroit Edison Co., Detroit, Mich., at the February meeting. Pres. D. S. Falk was the presiding officer. Attendance 130.

• *MICHIGAN*: At the Michigan Chapter's January meeting, H. A. Wagner spoke on *Heat and Power from Atomic Energy*. The program was given by the central heating department of the Detroit Edison Co. No business was conducted at the meeting. Attendance 129.

• *MINNESOTA*: Vice Pres. E. T. Erickson introduced the February speaker, L. J. Ress, chief engineer, Mueller Climatrol Division, Worthington Corp., Milwaukee, Wisc. Mr. Ress' subject was the *Rating and Performance of Domestic Warm Air Heating Equipment*.

John E. Haines, past president of the Society, presented a Life Membership certificate to A. J. Huck. Chapter Pres. J. S. Locke reviewed the 1956 Annual Meeting. Members of the nominating committee were elected as follows: A. B. Algren, V. E. Pearson, G. M. Kendrick, William Sturm and E. J. Uhl. Attendance 127.

• *MISSISSIPPI*: Pres. B. L. Palmer introduced the February speaker, Frank Gall, sales promotion manager, Bell & Gossett Co., Morton Grove, Ill. Mr. Gall gave an interesting talk on *Pump and Pipe Selection for Remote Room Air Conditioners*.

A report on his trip to the 1956 Annual Meeting was given by President Palmer, who had served as a member of the Chapters Conference Committee. Attendance 30.

• *MONTREAL*: Pres. R. J. Ker at the January meeting introduced J. H. Fox, member of Council, and general sales manager, Minneapolis-Honeywell Regulator Co., Ltd., Toronto, Ont. Mr. Fox briefly outlined the new Regional Plan and commented on his recent visits to the Canadian chapters.

The main speaker, Ralph Grossman, secretary-treasurer, Combustion & Power Equipment Ltd., Montreal, described *Some Effects of the Growing Use of Fuel Oil in Canada*. R. R. Duquette presented Mr. Grossman, who covered the past record and future possibilities of all types of fuels, including those used in atomic reactors. Attendance 67.

• *NEBRASKA*: Prof. S. V. Williams, head, engineering department, University of Omaha, spoke at the February meeting on *People, Prosperity and Progress*.

Business of the meeting included a report on the Chapters Conference Committee meeting at the 1956 Annual Meeting and discussion on future programs and regional meetings. Attendance 27.

• *NEW MEXICO*: The history of the advance of *Air Movement for Ventilation and Heating* was covered by E. K. Campbell, president, E. K. Campbell Co., Kansas City, Mo., at the meeting in February. Mr. Campbell also spoke of the meeting of Life Members at the Society's 1956 Annual Meeting.

C. G. Davis told of the Chapters Conference Committee meeting held during the Annual Meeting. J. K. James was elected a member of the Chapters Regional Committee.

It was announced that the board of governors of the chapter had selected J. R. Dion, R. P. Lee and J. M. Huff to serve as a nominating committee. Attendance 47. Attendance ratio 0.83.

• *NEW MEXICO*: Three aspects of the subject of cooling towers—design, types, and testing—were discussed at the January

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meeting by Pete Phelps, Santa Fe Tank & Tower Co., Los Angeles, Calif. The questions following the talk applied mainly to a high, dry climate.

Pres. H. F. Munn presided. Attendance 48. Attendance ratio 0.82.

• *NEW YORK*: At the February meeting of New York Chapter, P. B. Gordon, first vice president of the Society, reported that the Chapters Regional Committee Meeting held in Portland was highly successful and had been well received by the members and officers in attendance. Vice Pres. Gordon explained the operation of the new Regional Plan and showed how it gives the chapters and members a greater opportunity to influence Society operation and maintain close contact with the Council and Officers.

J. B. Hewett, program chairman, introduced D. H. Vance, vice president and executive engineer, The Korfund Co., Inc., Long Island City, N.Y. Mr. Vance spoke on *Vibration and Noise Control for Air-Conditioning Equipment*, explaining the theory of vibration and noise control and demonstrating the action of various types of isolation media.

Pres. Albert Giannini appointed an auditing committee, consisting of H. S. Johnson, as chairman, J. E. Schechter and W. B. Foxhall. The president reported that a nominating committee, composed of the last 5 past presidents of the chapter, with Prof. C. F. Kayan as chairman, was preparing a list of nominees for 1957 officers. Attendance 75. Attendance ratio 0.18.

• *NORTH JERSEY*: J. W. May, technical director, Air Filter Division, American Air Filter Co., Inc., Louisville, Ky.,

J. W. May
Louisville, Ky.

spoke in February on the *Selection and Application of Air Filters*, giving performance and service requirements.

Appointed to the nominating committee were F. H. Faust, Herbert Fox and B. R. Morrison. Vice Pres. W. C. Kruse, Jr., was the presiding officer. Attendance 57.

• *NORTH TEXAS*: A thorough discussion of the *Selection and Application of Air Filters* was presented in February by J. W. May, technical director, Air Filter Division, American Air Filter Co., Inc., Louisville, Ky. Mr. May described the performance characteristics and principles of operation of viscous impingement, dry or semi-dry, and electrostatic filters. He then discussed the initial resistance, comparative efficiencies and life expectancy of each of the types and showed how each had definite application for performance of specific tasks. The speaker also covered the maintenance problem.

G. H. Meffert, member, Chapters Conference Committee, reported on the 1956 Annual Meeting and described the operation of the new Regional Plan. Attendance 102.

• *NORTHEASTERN OKLAHOMA*: Committees named by Pres. H. W. Meinholtz at the February meeting were as follows: *Program*—J. D. Shaw and L. B. Bury; *Membership*—R. E. Pauling, Jr. D. Ryan and R. W. Winget; *Calling*—F. M. Thomas, L. T. Dever, W. R. Lee and B. F. Purifoy; and *Publicity*—F. M. Thomas.

R. L. Sigler introduced J. L. Hoyer, national product manager, air conditioning, Rheem Manufacturing Co., Chicago, Ill., whose topic was *Residential Air Conditioning: A New Low in Initial and Operating Costs*. Mr. Hoyer suggested the application of basic refrigeration principles to obtain optimum amount of refrigeration per horsepower. Attendance 42.

• *NORTHERN PIEDMONT*: The Northern Piedmont Chapter of the Society acted as host to the North Carolina Chapter of *ASRE* at a joint meeting held in February.

Pres. L. R. Gorrell, who was the presiding officer, introduced Prof. R. B. Knight, North Carolina State College, who in turn presented the speaker. The guest speaker was R. L. Berner, Glenn L. Martin Co., whose subject was *Air Conditioning for Aircraft*. After a fascinating discussion by Mr. Berner and a short question and answer period the meeting was adjourned. Attendance 59. Attendance ratio 0.31.

• *NORTHERN PIEDMONT*: *Selection of Alternating Current Motors for Application to Air Conditioning, Heating, Ventilating and Refrigeration Equipment* was the topic of the January speaker, Donald Jensen, Wagner Electric Corp., St. Louis, Mo. G. B. Rottman, who had arranged the program for this meeting, introduced the speaker.

Pres. L. R. Gorrell suggested that a precedent be set by which the vice president of the chapter automatically be chairman of the program committee, since the vice president's position had been rather inactive and since better programs might be arranged. President Gorrell also reported on the various activities of the Annual Meeting.

Committee chairmen for the coming year were announced as follows: *Program*—C. A. Cofer; *Attendance*—H. B. Hoffman and *Special Events*—President Gorrell. Attendance 25. Attendance ratio 0.17.

• *OKLAHOMA*: Chapter attendance reached a new high at the February meeting. The speaker was J. L. Hoyer, national product manager, air conditioning, Rheem Manufacturing Co., Chicago, Ill., who discussed *Residential Air Conditioning: A New Low in Initial and Operating Costs*. Following the presentation, Mr. Hoyer answered many questions concerning laboratory and field tests. Pres. J. R. Patten presided. Attendance 91. Attendance ratio 0.53.

• *ONTARIO*: University of Toronto branch members were introduced as guests by Mrs. M. F. Hoare at the February meeting presided over by Pres. D. L. Angus.

After presentation of Life Members and out-of-town guests by the president, Jack Thompson introduced as speaker A. W. Manby, general manager, Hydro-Electric Power Commission of Ontario. His subject was *Canada's Power Resource Taxed by Thriving Economy*. Mr. Manby said the commission intended to augment hydro developments with steam power and nuclear energy generation to meet the increasing power requirements of the Province. Attendance 104.

• *OREGON*: The coffee talk at the January meeting was given by E. S. Constant on *Ventilating Requirements*. His informative talk was based on research papers which have been presented at Society meetings.

T. H. McClung introduced the guest speaker, Eugene Wyatt, Gates Rubber Co., Denver, Colo. In his presentation on *V-Belt Drives*, Mr. Wyatt described the various types of V-belts and their applications, and worked out a typical selection problem in detail. An interesting discussion period followed.

A brief speech of acceptance was delivered by J. P. McDermott, general chairman of the then forthcoming regional meeting. H. W. McKenzie, J. D. Kroeker and W. R. Norte reported on the activities, program and housing accommodations for that meeting. The selections of the nominating committee were read by B. W. Farnes. Attendance 63. Attendance ratio 0.34.

• *OTTAWA VALLEY*: J. H. Fox, member of Council, reported on By-Law changes affecting regional organization of the Society in his annual message to the chapter at their January meeting presided over by Vice Pres. D. W. Benton.

The annual open discussion night was held after the conclusion of the business meeting on *Specifications, Their Intent and Interpretation*. W. W. Davis was in the chair.

Six speakers covered all aspects of the responsibilities and difficulties contingent upon their various professional approaches to the subject. The legal viewpoint was represented by C. R. O. Munro, Department of Justice, and legal advisor to the Department of Public Works, who stressed that specifications formed an integral part of the contract. G. A. Wild discussed the owner's attitude; Jacob Klassen and A. S. Lawson gave the consulting engineer's and contractor's viewpoints, respectively; and

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R. J. Hipkin and C. W. Watson, chapter secretary, spoke briefly for the manufacturer and supplier. Attendance 37. Attendance ratio 0.50.

• *PHILADELPHIA*: Members at the February meeting heard H. W. Alyea, chief field engineer, Johnson Service Co., Milwaukee, Wis., speak on *New Trends in Automatic Control*.

Prior to Mr. Alyea's talk, presidential member Merrill F. Blankin, spoke on *Engineers Week*, requesting attendance at a luncheon honoring Francis S. Friel, engineer of the year. The meeting was presided over by Pres. A. M. Robertson. Attendance 73.

• *PITTSBURGH*: An attentive audience at the February meeting listened to J. B. Olivieri, chief mechanical engineer, Victor Gruen Associates, Inc., Detroit, Mich., speak on *Heating, Ventilating and Air-Conditioning Shopping Centers*.

Mr. Olivieri, who was introduced by Program Chairman E. J. Busch, divided the centers into three types: strip, mall and cluster. He considered their initial and operating costs, architectural effect and flexibility. He found that the mall center was the most flexible with a medium cost, that the strip center had the lowest first and operating costs, while the cluster type was both the most expensive and the least flexible.

At the business meeting prior to the talk, the following were elected to the nominating committee: E. C. Smyers, chairman; D. W. Loucks and A. F. Nass, Sr. Members elected to the auditing committee were: R. H. Porter, chairman; I. C. Laux and F. W. Heckler. The meeting was presided over by Pres. C. L. Benn. Attendance 78.

• *ROCKY MOUNTAIN*: A. S. Widdowfield, chairman pro-tem of the February meeting, presented R. F. Throne, mechanical engineer, Public Service Co. of Colorado, who gave a review of the *Economic Aspects of the Arapahoe Steam Electric Station*. After Mr. Throne's remarks, the group adjourned to the Arapahoe Station where guides conducted the members and guests through the thoroughly modern steam-electric generating station. The numerous applications of pumps, fans and cooling towers were of interest to the group. Attendance 27.

• *SACRAMENTO VALLEY*: Pres. R. A. Sarro reported on the 62nd Annual Meeting held in Cincinnati, Ohio, to members at the February meeting of the chapter.

V. W. Thornburg then introduced guest speakers R. F. Allen, branch manager, Unitary Equipment Division, and Earl Carrier, manager, Machinery Equipment Division, Carrier Corp., San Francisco, Calif. Mr. Allen and Mr. Carrier presented interesting discussions on the latest developments in all phases of residential and commercial air conditioning. Attendance 86. Attendance ratio 0.37.

• *ST. LOUIS*: The vice chairman of the St. Louis Chapter of *ASRE*, John Schenck, introduced the officers of the St. Louis Chapters of ASHAE and *ASRE* present at the joint February meeting.

Henry Kipp presented the speaker, L. A. Zwickes, Harrison Radiator Division, General Motors Corp., Lockport, N.Y., who noted future trends in automotive air conditioning.

• *ST. LOUIS*: *Snow Melting Systems — Design and Operation* was the topic presented at the January meeting by W. P. Chapman, Engineering sales service representative, National Tube Division, U. S. Steel Corp., Pittsburgh, Pa. W. P. Norris, program chairman, introduced the speaker. Pres. E. T. Clucas presided.

• *SHREVEPORT*: Appointment of members to the Chapters Regional Committee was discussed at the February meeting, the Chapter electing H. E. Scott as member and A. L. Jones, Jr., as alternate member. S. W. Beaty, member, Chapters Conference Committee, reported in detail on the Regional set-up and the 1956 Annual Meeting in general.

Earl Meyers gave an interesting and informative talk on *Hot Water Specialties and Their Effect on Commercial Installations*. Attendance 28.

• *SOUTH CAROLINA*: A joint meeting was held in February with the Columbia Chapter of the *National Society of Professional Engineers* in celebration of National Engineers' Week. Ladies were invited, and all engineers and engineering societies were invited to participate. No business was transacted.

Prior to dinner, an address on the importance of the engineer in today's society was given by R. L. Sumwalt, dean, School of Engineering, University of South Carolina. Chapter Pres. R. K. Rouse then reported briefly on the 1956 Annual Meeting and on the recent *NSPE* meeting in Washington. Attendance 228. Attendance ratio 0.50.

• *SOUTH CAROLINA*: The program for the January meeting, at which Pres. R. K. Rouse presided, consisted of a *Contractor's Panel Discussion*. The members of the panel were L. L. Hyatt, J. E. Waldrep, F. P. Gary and H. L. McDowell. J. E. McMurray acted as moderator, directing questions to the panel which had been submitted by the membership. Attendance 37. Attendance ratio 0.37.

• *SOUTH TEXAS*: Appointed to the Chapters Regional Committee at the February meeting were A. B. Ulfrich, Jr., as member, and J. C. Lewis, alternate member.

At the close of the business session, A. F. Barnes introduced Mr. Danenbaum, consulting engineer, whose subject was the *Professional Engineer*. Attendance 44.

• *SOUTH TEXAS*: *What Motivates an Engineer to Select a Particular Type of System of Air Conditioning in a Large Office Building* was the subject of a panel discussion in January when the business meeting presided over by Pres. F. M. Neil was concluded.

Program Chairman J. C. Lewis introduced D. S. Cooper, panel moderator. Panel members were: Bernard Johnson, consulting engineer; Winston Booker, building manager, Jones Interests; and Talbot Wilson, *F.A.I.A.*, Wilson, Morris & Crain. Several designs of air-conditioning systems were discussed in detail by the panel, taking into account the individual preferences of the architects, engineers and building owners concerned. A lively question session ended the discussion. Attendance 67.

• *SOUTHERN CALIFORNIA*: An interesting presentation on *Water Problems in Air Conditioning* was given in February by Mr. Wescott of Holiday and Wescott.

President, J. L. McCullough and A. J. Hess, member of Council encouraged attendance at the meeting of the Chapters Regional Committee, Region 4, held in Portland on February 17-18. Attendance 92.

• *SOUTHERN PIEDMONT*: Presentation by J. A. Rice of a past president's pin was made to L. F. Lawrence, retiring president of the chapter. Mr. Rice commended Mr. Lawrence for his presidential activities for the past season.

GRAHAM AND SANDIFER HONORED FOR ACHIEVEMENT

F. D. Graham, New Orleans, La., and R. S. Sandifer, Houston, Tex., have been named sales engineering councilors and all-star sales engineers, highest honors bestowed by the York Corp., York, Pa.

Mr. Graham is manager of the New Orleans office and Mr. Sandifer was recently appointed manager of the Dallas office. Both men, who are members of the Society, were named to the York Sales Engineering Hall of Fame for the fifth time as a result of their 1955 performances.

PIPING IDENTIFICATION STANDARDS REVISED

It is announced that *American Standards Association* has given its approval to the new American Standard Scheme for the Identification of Piping Systems. The sponsors of the project are National Safety Council and *The American Society of Mechanical Engineers*. *ASME* is the publisher of the code which is (ASA A13.1-1956). H. H. Bond, New York, N. Y., is the representative of ASHAE on the Committee which formulated this latest revision. Copies are available from *ASME* at $1.00 each.

Mr. Rice then introduced Judge Gatling of the Domestic Relations Court of Charlotte, N.C., who gave a very enlightening talk on the problems presented in the court. He said that many of these problems could be eliminated by a proper home and church environment for the children. Attendance ratio 0.46.

• *TOLEDO*: Pres. C. F. Hoffman, presiding at the February meeting, reported on the Chapters Conference Committee meeting held in conjunction with the 1956 Annual Meeting.

A by-laws amendment, as accepted by the board of governors prior to the chapter meeting, was read to the membership. This named the president and vice president of the chapter as member and alternate member, respectively, of the Chapters Regional Committee.

Presentation of candidates for engineer of the year was conducted by Robert Greenwald, chairman of the nominating committee established for this purpose. By secret ballot President Hoffman was selected as the candidate for the Toledo Technical Council engineer of the year.

A tour of the Toledo Edison Bay Shore plant followed the meeting. Attendance 41. Attendance ratio 0.45.

• *VIRGINIA*: A descriptive talk on *Conduits for Underground Piping* was given in February by A. C. Carlson, conduit department, H. W. Porter & Co., Inc., Newark, N.J. A. B. Miller, who as program chairman presented the speaker, reported on the 1956 Annual Meeting, which he had attended as a member of the Chapters Conference Committee.

C. G. Conaway, Jr., newly elected president, was the presiding officer. Attendance 27. Attendance ratio 0.30.

• *VIRGINIA*: The annual Ladies' Night together with the installation of officers was held in January. Following a short business session, the 1956 officers were installed: *President*—C. G. Conaway, Jr.; *Vice President*—D. C. Delinger; *Secretary*—E. R. Simpson, Jr.; *Treasurer*—W. L. Gibson; *Board of Governors*—A. R. Thompson, Jr., and A. B. Miller. Attendance 32. Attendance ratio 0.40.

• *WESTERN MASSACHUSETTS*: Elected by the membership at the February meeting to serve on the nominating committee were R. J. Hildreth, as chairman, W. C. Grady, T. E. Fallon, W. B. Murphy, and R. B. Kirkpatrick.

Vice Pres. J. E. Reed, program committee chairman, introduced L. E. Seeley, a past president of the Society, and vice president in charge of engineering, H. B. Smith Co., Inc., Westfield, Mass. Dean Seeley posed for the Chapter's consideration several actual and predicted trends toward future developments in the methods of heating and air conditioning.

Several members and guests had participated in a tour through the plant facilities of the H. B. Smith Co. during the afternoon preceding the meeting. Attendance 41. Attendance ratio 0.45.

• *WESTERN MASSACHUSETTS*: Vice Pres. J. E. Reed introduced a three-man panel at the January meeting: P. D. Harrigan, consulting engineer, Harrigan-Hill, New Haven, Conn.; E. R. Clement, president, E. R. Clement, Inc., Bridgeport, Conn.; and George Eaton, president, Foskett & Bishop Co., New Haven. With Vice President Reed acting as moderator, the panel discussed problems which arise in the relationships between the engineer, contractor, and manufacturer's representatives; the solutions to these problems; and what each person involved expects of the others.

S. K. Smith reported on the accomplishments of the Chapters Conference Committee at the Annual Meeting. Mr. Smith and A. M. Lovenberg, who served as alternate member and member of that committee, were certified for the same roles with the Chapters Regional Committee. Pres. R. E. Cross presided. Attendance 47. Attendance ratio 0.41.

• *WESTERN MICHIGAN*: *Glass As an Engineering Material* was the subject of the presentation by W. G. Shearer, senior engineer, Corning Glass Works, Corning, N.Y., at the February meeting. Program Chairman F. K. Platt introduced the speaker, who discussed the early history of glass making, and various types and characteristics of glass. Mr. Kelm, acting as Mr. Shearer's assistant, described glass used in heating panels, resistors or heat reflectors. A test panel was plugged for the members to observe. Members and guests participated in the question and answer period following.

A Life Membership certificate was presented to C. R. McConner. Pres. S. M. Paganelli, the presiding officer, briefed the members on the 1956 Annual Meeting. Attendance 56.

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CONTRACTORS SERVICE AWARD TO GORDON

It is announced that First Vice Pres. P. B. Gordon is the recipient of the Distinguished Service Award for 1956, given by the *Heating, Piping and Air Conditioning Contractors National Association*. The Award is made annually to a selected member of the Association for outstanding service to both the industry and the Association.

P. B. Gordon
New York, N. Y.

While thus outstandingly active in the affairs of *HP & ACCNA*, Mr. Gordon is not only currently first vice president of the Society, but is also vice president of Wolff & Munier, Inc., New York.

One of his present activities in connection with the Society is that of taking part in the organization of the Regional Operations Plan.

CANDIDATES FOR MEMBERSHIP

Listed here are the names of 129 men who are candidates for membership, or advancement in membership grade.

Members are requested to assume their full share of responsibility of receiving these candidates into membership by advising the Executive Secretary before May 31, 1956, of any whose eligibility for membership is questioned. Unless such objection is made these candidates will be voted upon by the Council.

Note: †Reinstatement *Advancement

Arizona (*Region* 4)

MOORE, G. T.†, Sales Engr., American Blower Corp., Phoenix.

California (*Region* 4)

GLADSTONE, S. H., Jr. Designer, Pereira & Luckman, Los Angeles.

HABERKORN, G. B., Sales Engr., Gustin-Bacon Manufacturing Co., San Francisco.

HAYAKAWA, T. G., Assoc., A. Z. Levine & R. J. McCann, Associated Mech. Engrs., Los Angeles.

HUGHES, E. W., Repr., Pacific Scientific Co., San Francisco.

KOPF, C. W., Sales Engr., Powers Regulator Co., San Francisco.

RATHBUN, S. S., Jr., Field Service Engr., A. M. Byers Co., San Francisco.

REPP, D. L., Mfrs. Repr., Norman S. Wright & Co., Sacramento.

SCULLY, T. F., Sales Engr., Heat & Power Equipment Co., Los Angeles.

SKINNER, R. D., Sales Engr., Bush Manufacturing Co., Riverside.

STEELE, R. W., Designer, Pereira & Luckman, Los Angeles.

WILLIAMS, H. C., Sales Engr., English-Lauer, Los Angeles.

Connecticut (*Region* 1)

PERRIN, C. B., Estimator, Industrial Sheet Metal Co., Orange.

Delaware (*Region* 1)

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Journal Section

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Schack, Leon, Chief Engr., McCreery Brothers & Co., Pittsburgh.

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Huff, J. L., Mech. Engr., Davis & Foster, El Paso.

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Crossey, R. E., Mech. Engr., Jas. P. Keith & Assocs., Montreal, Que.

Fournier, E. J., Cons. Engr., Quebec, Que.

Gans, Nathan, Partner, Gans, Kofman & Assoc., Cons. Engr., Montreal, Que.

Journal Section

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Landray, P. B., Sales Repr., John Inglis Co., Ltd., Montreal, Que.

Langlais, P. H., Asst. Chief Engr., Zachee & Pierre Langlais, Cons. Engrs., Montreal, Que.

Snider, P. H., Mgr.-Indus. Div., Western Insulation Co., Ltd., Vancouver, B. C.

Williams, James, Research Fellow, Ontario Research Foundation, Toronto, Ont.

Turkey

Nahum, G. A., Cons. Engr., Ankara.

OBITUARIES

JOHN FREI
Berne, Switzerland

John Frei, vice president of the Switzerland Special Branch, died at the age of 51 after an extended illness. Dr. Frei came to rest in Berne on February 21.

As director and president of Sifrag, Berne, Dr. Frei had worked on hundreds of large ventilating and air-conditioning installations in various European and overseas countries, as well as in Switzerland.

Dr. Frei was born in Ludwigshafen, Switzerland, on April 28, 1904. He gained engineering knowledge at the Swiss Federal School of Technology in Zurich. Before he became president of Sifrag in 1939, he served with Landis & Gyr, Ltd.

He is survived by his wife and a daughter.

FRANK E. P. KLAGES
Greensboro, N.C.

One of the founders of the North Carolina Chapter, Frank E. P. Klages, 63, died on January 6. An active Society member, Mr. Klages served the North Carolina Chapter, which was later divided into the Northern Piedmont and Southern Piedmont Chapters, as president in 1944 and as a member of the board of governors in 1942 and 1945. He was selected as representative for the Nominating Committee for 1943.

An outstanding engineer in the thermostatic control field, Mr. Klages was district manager for The Powers Regulator Co. in their Greenboro, N. C., office since it was opened in 1936. He first joined The Powers Regulator Co. in 1922, following service with the United States Navy. For five years he remained in the Chicago district as a sales engineer. He was then sent to Atlanta, Ga., to become Southern District Manager. In 1931 he returned to Chicago to do research engineering as an assistant to F. W. Powers, president of the company.

Mr. Klages is survived by his wife, Gladys; a daughter, Mrs. William D. Seawell; a son, F. E. P. Klages, Jr.; and three grandchildren, W. D. Seawell, Jr., Virginia Lee Seawell, and F. E. P. Klages, III.

J. R. LUCIEN L'ESPERANCE
Montreal, Que.

The Society has learned recently of the death of J. R. Lucien L'Esperance, manager and owner, Metropolitan Plumbing & Heating Co., Ltd., Montreal. Mr. L'Esperance was 62 years old at the time of his death.

A native of Montreal, Mr. L'Esperance attended Holy Cross College, St. Laurent, Que. Previous to gaining ownership of the Metropolitan Plumbing & Heating Co. in 1923, he acted as estimator and general superintendent of W. G. McGuire & Co., Ltd., Toronto and Montreal, and Thomas O'Connell, Ltd., Montreal.

Mr. L'Esperance had been a member of the Society since 1948. His son, Lucien L'Esperance, Jr., who is also a member of ASHAE, survives.

JOHN D. ROSS
Montreal, Que.

The Society has learned of the recent death of John D. Ross, vice president, Railway & Engineering Specialties, Ltd., Montreal, Que. His passing, at the age of 58, was preceded by an extended illness. Mr. Ross had been a member of the Society since 1937 and was a longtime member of the Montreal Chapter.

A native of Crieff, Scotland, Mr. Ross came to Montreal at the age of nine and lived there ever since. He served with the Royal Canadian Engineers during World War I and in the second World War held

the rank of major in the 17th Duke of York Royal Canadian Hussars, reserve unit. During the 1930's he worked as a sales engineer for the Railway & Engineering Specialties, Ltd.

Mr. Ross is survived by his wife, Esther; a son, D. A. Ross of Cheshire, Conn.; a daughter, Mrs. W. E. Sims, of Lachine, Que.; and a brother, D. A. Ross of Toronto.

ELMER A. WHITELAW
Chicago, Ill.

After an illness of long duration, Elmer A. Whitelaw, a member of the Society since 1950, died at the age of 64 on January 23. Mr. Whitelaw had held the position of mechanical engineer with Edward J. Wolff, consulting engineer, Chicago, Ill.

Born in Chicago on January 10, 1892, Mr. Whitelaw furthered his knowledge of steam combustion at Armour Institute. He was connected with the Cross Ventilation Co., Sears Roebuck & co., and Holabird & Root & Burgee. He worked with Rueter & Wolff beginning in 1948.

Surviving is his widow, who resides in Chicago.

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La.	Baton Rouge	L. F. Naylor, Jr.	C. S. Woodruff
Md.	Baltimore	E. J. Morris	W. G. Robertson, Jr.
Miss.	Miss. (Jackson)	R. L. Palmer	Burt Lomax, Jr.
N. C.	No. Piedmont (Greensboro)	C. E. Amick	C. A. Coler
N. C.	So. Piedmont (Charlotte)	G. C. Garrett	W. P. Wells
S. C.	S. Carolina (Columbia)	R. K. Rouse	L. F. McMurray
Tenn.	Memphis	W. L. Henson	B. H. Belding
Va.	Virginia (Norfolk)	E. R. Simpson, Jr.	
D. C.	Washington, D. C.	P. R. Achenbach	W. C. Reamy
W. Va.			

Region 6 — Regional Director: D. M. Mills

Ark.	Arkansas (Little Rock)	J. W. Thompson	W. A. Bullard
La.	Shreveport	H. E. Scott	A. L. Jones, Jr.
N. Mex.	N. Mex. (Albuquerque)	J. F. James	
Okla.	N. East. Okla. (Tulsa)	C. H. Dollmeyer	J. D. Ryan
Okla.	Okla. (Oklahoma City)	F. R. Denham	W. R. Johnson
Texas	North Texas (Dallas)	G. H. Meffert	E. T. Gessell
Texas	South Texas (Houston)	A. B. Ulrich, Jr.	J. C. Lewis
Texas	S. W. Texas (San Antonio)	D. T. Kern	M. E. Staley
Texas	West Texas (Lubbock)	L. F. Davidson	R. A. Mixon

Region 7 — Regional Director: John H. Fox

B. C.	British Columbia (Vancouver)	Cornelius Van Breyen	A. C. Martin
Man.	Manitoba (Winnipeg)	A. H. Miller	G. C. Davis
Que.	Montreal	H. G. S. Murray	D. L. Lindsay
Ont.	Ontario (Toronto)	C. J. Bootes	Charles Terry
Ont.	Ottawa Valley (Ottawa)	W. J. Robinson	F. J. Schoenherr
Alta.	No. Alberta (Edmonton)	P. M. Butler	E. K. Cumming

(Continued from page 174)

Marshall, L. J. Pecora, Sid Robinson, F. F. Snyder, Jr.* C. L. Taylor, T. L. Willmon, C. P. Yaglou.

Plant and Animal Husbandry: A. J. Hess, Chairman, H. A. Lockhart,* Vice Chairman, A. B. Algren, John Everetts, Jr.*, H. L. Ziel.

Sensations of Comfort: C. S. Leopold, Chairman, F. K. Hick,* M.D., Vice Chairman, John Everetts, Jr.*, M. K. Fahnestock, A. J. Hess.

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Standards: F. H. Faust, Chairman, C. H. Pesterfield (one year), K. T. Davis, C. B. Gamble (two years), A. B. Algren, A. B. Newton (three years).

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ASHAE Committee on Safety Regulations for Heating, Ventilating and Air Conditioning Systems: G. P. Nachman, Chairman, F. H. Buzzard, H. W. McKenzie, B. F. McIlouth, C. H. Randolph.

Committee for Revision of ASHAE Standard Code for Testing and Rating Return Line Low Vacuum Heating Pumps: W. M. Wallace, II, Chairman, H. E. Adams, H. S. Beam, A. H. Church, L. M. Hechtne, E. G. Powell, A. O. Roche, Jr., D. W. Whittington.

Joint Committee on Standards for Comfort Air Conditioning: W. L. Fleisher, Chairman, (ASHAE) O. W. Armstrong, A. C. Buensod, C. C. Cheyney, (ASME) C. F. Kayan, (ASRE) F. H. Faust, C. F. Holsee, S. P. Soling, (ARI) M. M. Lawler, R. A. Gonzalez, Alternate; J. R. Schreiner, (U.S. Public Health Service) W. C. Cooper, M.D.; At Large: M. K. Fahnestock, P. J. Marschall, G. E. May, A. B. Newton, (Medical Profession) R. W. Keeton, M.D., W. J. McConnell, M.D.

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*Member of Committee on Research.

ASHAE — OFFICERS OF CHAPTERS AND BRANCHES

(62 Chapters: 1 Special Branch: 6 Student Branches)

Date indicates year organized; an address and no city shown signifies same city as headquarters; numeral in parentheses indicates zone.

ARIZONA

Arizona: 1953. Hdqrs., Phoenix. Meets, 1st Mon. PRES, J. B. Hoagland, 1923 W. Osborn Rd. SECY, F. W. Gabbard, 111 East 14th St.

ARKANSAS

Arkansas: 1952. Hdqrs., Little Rock. Meets, 3rd Tues. PRES, J. L. Brown, 212 Terminal Warehouse Bldg. SECY, H. H. Himstedt, 510 E. Third St.

CALIFORNIA

Golden Gate: 1937. Hdqrs., San Francisco. Meets, 1st Thurs. PRES, D. E. McLeod, 2415 Green St. (23). SECY, Herb Duncan, 938 N. Linden Ave., South San Francisco.

Sacramento Valley: 1952. Hdqrs., Sacramento. Meets, 1st Wed. PRES, R. A. Sarro, 5412 Argo Way (21). SECY, M. J. Delavan, 405 Meister Way (19).

Southern California: 1930. Hdqrs., Los Angeles. Meets, 1st Tues. PRES, J. L. McCullough, 1978 S. Los Angeles St. (11). SECY, W. J. Biggar, 6620 Telegraph Rd. (22).

COLORADO

Rocky Mountain: 1944. Hdqrs., Denver. Meets, 1st Wed. PRES, A. S. Widdowfield, 1925 Blake St. (2). SECY, R. T. Beck, 1304 Cherokee St. (4).

CONNECTICUT

Connecticut: 1940. Hdqrs., New Haven. Meets, 3rd Thurs. PRES, E. J. Hoagland, 16 Oakwood Ave., West Hartford (7). SECY, J. D. Pierce, 775 Capitol Ave., Hartford.

DISTRICT OF COLUMBIA

Washington: 1935. Hdqrs., Washington, D.C. Meets, 2nd Wed. PRES, W. C. Reamy, Jr., 720 Mills Bldg. (6). SECY, S. H. Robbins, Jr., 2117 M Street, N.W. (7).

GEORGIA

Atlanta: 1937. Hdqrs., Atlanta. Meets, 2nd Mon. PRES, T. A. Barrow, Jr., 302 Ponce de Leon Ave., N.E. (8). SECY, J. A. Marshall, 1415 Howell Mill Rd., N.W.

ILLINOIS

Illinois: 1906. Hdqrs., Chicago. Meets, 2nd Mon. PRES, G. G. Freyder, 72 W. Adams St. (90). SECY, Herbert Kreisman, 117 N. Desplaines St. (6).

INDIANA

Indiana: 1943. Hdqrs., Indianapolis. Meets, 4th Tues. PRES, J. W. Jackson, 1531 N. Pennsylvania St. (2). SECY, G. W. Vogel, 31 E. Georgia St. (4).

IOWA

Iowa: 1940. Hdqrs., Des Moines. Meets, 2nd Tues. PRES, G. J. Kraai, 907 Sixth Ave. (14). SECY, W. A. Schworm, Physical Plant Dept., Iowa State College, Ames.

KANSAS

Kansas: 1951. Hdqrs., Wichita. Meets, Tues. after 1st Mon. PRES, A. B. Newton, 3511 Elmwood Dr. (17). SECY, T. L. Roberts, 2008 S. Parkwood Lane (18).

KENTUCKY

Bluegrass: 1954. Hdqrs., Louisville. Meets, 2nd Mon. PRES, W. M. Pace, 218 Don Allen Rd. (7). SECY, R. B. Duggan, 41 Beechwood Rd., Jeffersonville, Ind.

LOUISIANA

Baton Rouge: 1955. Hdqrs., Baton Rouge. Meets, 3rd Wed. PRES, C. S. Woodruff, P.O. Box 358. SECY, A. J. Mayers, Jr., 7732 Goodwood Ave.

Delta: 1939. Hdqrs., New Orleans. Meets, 3rd Tues. PRES, W. B. Martin, Jr., 635 Commercial Pl. (12). SECY, R. K. Goode, 4052 Thalia St. (25).

Shreveport: 1948. Hdqrs., Shreveport. Meets, 3rd Thurs. PRES, R. S. Segall, 848 River Rd. SECY, A. L. Jones, Jr., 753 Gladstone.

MARYLAND

Baltimore: 1949. Hdqrs., Baltimore. Meets, 3rd Wed. PRES, E. J. Morris, 813 N. Calvert St. (2). SECY, L. J. Dull, 1122 N. Charles St. (1).

MASSACHUSETTS

Massachusetts: 1912. Hdqrs., Boston. Meets, 3rd Tues. PRES, G. D. Fife, 79 Milk St. SECY, R. F. Curry, 80 Ripley St., Newton Centre (59).

Western Massachusetts: 1955. Hdqrs., Springfield. PRES, R. E. Cross, 114 Boston Rd. SECY, F. A. Ferraro, 172 Chestnut St.

MICHIGAN

Michigan: 1916. Hdqrs., Detroit. Meets, 1st Mon. after 10th of month. PRES, D. S. Falk, 4864 Woodward Ave. (1). SECY, J. H. Spitzley, 1200 W. Fort St. (26).

Western Michigan: 1931. Hdqrs., Grand Rapids. Meets, 2nd Mon. PRES, S. M. Paganelli, 47 N. Division Ave. SECY, B. J. Walter, 333 Fuller Ave., N.E.

MINNESOTA

Minnesota: 1918. Hdqrs., Minneapolis. Meets, 1st Mon. PRES, J. S. Locke, 2753 Fourth Ave., S. (8). SECY, F. G. Vogt, 6530 W. Lake St. (16).

MISSISSIPPI

Mississippi: 1953. Hdqrs., Jackson. Meets, 4th Mon. PRES, B. L. Palmer, 1808 N. Mill St. (2). SECY, M. F. Knipp, Jr., 2858 Arbor Hill Dr. (4).

MISSOURI

Kansas City: 1917. Hdqrs., Kansas City. Meets, 1st Mon. PRES, A. S. Hurt, Jr., 5601 E. 18th St. (27). SECY, S. C. McCann, 210 W. Tenth St. (5).

St. Louis: 1918. Hdqrs., St. Louis. Meets, 2nd Tues. PRES, E. T. Clucas, 4354 Olive St. SECY, N. J. Hubbuch, Jr., 7020 Cornell, University City (5).

NEBRASKA

Nebraska: 1940. Hdqrs., Omaha. Meets, 2nd Tues. PRES, T. E. Davis, 4303 Dodge St. SECY, C. A. Faller, 1802 Mason St. (2).

NEW JERSEY

North Jersey: 1952. Hdqrs., Newark. Meets, 2nd Tues. PRES, C. H. Smith, 2300 N. Stiles St., Linden. SECY, M. C. Christesen, 196 Everett Pl., Englewood.

NEW MEXICO

New Mexico: 1954. Hdqrs., Albuquerque. Meets, 3rd Mon. PRES, H. F. Munn, 419 Granite, N.W. SECY, J. K. James, 4462 Avenida del Sol.

NEW YORK

Central New York: 1944. Hdqrs., Syracuse. Meets, 4th Wed. PRES, L. A. Childs, 308 Forest Hill Dr. (6). SECY, Merle Weninger, 230 Goodrich Ave. (5).

Empire State Capital: 1951. Hdqrs., Albany. Meets, 2nd Wed. PRES, L. V. Appleby, N. Pearl & Van Woert Sts. (4). SECY, E. J. Mahoney, 45 Colvin Ave.

New York: 1911. Hdqrs., New York. Meets, 3rd Mon. PRES, Albert Giannini, 385 Madison Ave. (17). SECY, Carl H. Flink, 62 Worth St. (13).

Western New York: 1919. Hdqrs., Buffalo. Meets 2nd Mon. PRES, C. W. Kaupp, 271 Delaware Ave. (2). SECY, J. P. Guerra, 34 E. Depew Ave. (14).

NORTH CAROLINA

Northern Piedmont: 1952. Hdqrs., Greensboro. Meets, 2nd or 3rd Fri. PRES, L. R. Gorrell, 1412 Chester Rd., Raleigh. SECY, C. E. Amick, 1042 Oakmont Ave.

Southern Piedmont: 1952. Hdqrs., Charlotte. PRES, J. A. Rice, 719 E. Worthington Ave. SECY, L. D. Streng, P.O. Box 4063.

OHIO

Central Ohio: 1944. Hdqrs., Columbus. Meets, 3rd Mon. PRES, R. A. Wilson, 2240 N. High St. SECY, T. R. Walker, 182 N. Yale Ave.

Cincinnati: 1932. Hdqrs., Cincinnati. Meets, 1st Tues. PRES, A. H. Gerdsen, 224 E. Second St. (2). SECY, T. D. Reiley, 1905 Dunlap St. (14).

Miami Valley: 1950. Hdqrs., Dayton. Meets, 1st Wed. PRES, D. E. Tullis, 1720 Parkhill Drive (6). SECY, L. P. Brehm, Jr., 111 S. Broomfield Rd.

Northern Ohio: 1916. Hdqrs., Cleveland. Meets, 2nd Mon. PRES, L. C. Burkes, 1792 E. 40th St. SECY, R. A. Urban, Sr., 1740 E. 12th St. (14).

Toledo: 1954. Hdqrs., Toledo. PRES, C. F. Hoffman, 523 Spitzer Bldg. (4). SECY, R. I. Fruth, 1316 Adams St. (2).

OKLAHOMA

Oklahoma: 1935. Hdqrs., Oklahoma City. Meets, 2nd Mon. PRES, J. R. Patten, 1726 N.W. Fifth (6). SECY, A. C. Shelley, 2946 Nimitz (12).

Northeastern Oklahoma: 1948. Hdqrs., Tulsa. Meets, 2nd Tues. PRES, H. W. Meinhoitz, Box 2261. SECY, H. L. Cauvel, 3342 East 41st St.

OREGON

Oregon: 1939. Hdqrs., Portland. Meets, Thurs. after 1st Tues. PRES, W. R. Norte, 2225 N. E. Broadway (12). SECY, G. G. Van Alst, 947 S. E. Market.

PENNSYLVANIA

Philadelphia: 1916. Hdqrs., Philadelphia. Meets, 2nd Thurs. PRES, A. M. Robertson, 1200 Locust St. (7). SECY, J. J. Hucker, 355-C Lancaster Ave., Haverford.

Pittsburgh: 1919. Hdqrs., Pittsburgh. Meets, 3rd Mon. PRES, C. L. Benn, 420 Blvd. of Allies (19). SECY, E. H. Riesmeyer, Jr., 231-33 Fort Pitt Blvd. (22).

SOUTH CAROLINA

South Carolina: 1954. Hdqrs., Columbia. PRES, R. K. Rouse, P.O. Box 3731, Greenville. SECY, B. A. Leppard, P.O. Box 3353, Station A, Greenville.

TENNESSEE

Memphis: 1944. Hdqrs., Memphis. Meets, 3rd Mon. PRES, John Hilton, II, 4443 Sequoia. SECY, L. V. Eberle, Jr., 1358 Clementina.

TEXAS

North Texas: 1938. Hdqrs., Dallas. Meets, 3rd Mon. PRES, H. G. Gregerson, 4512 Livingston (5). SECY, Ross Zumwalt, 929 Mercantile Securities Bldg. (1).

South Texas: 1938. Hdqrs., Houston. Meets, 3rd Fri. PRES, F. M. Neil, P.O. Box 13197 (19). SECY, A. B. Ullrich, 2520 Huldy St. (19).

Southwest Texas: 1946. Hdqrs., San Antonio. Meets 3rd Tues. PRES, F. B. Frazee, 1013 Riverside Dr., Austin (4). SECY, J. L. Rea, Jr., 300 West 6th St., Austin.

West Texas: 1953. Hdqrs., Lubbock. Meets, 1st Tues. PRES, J. C. Wharton, P. O. Box 1240. SECY, D. G. Halley, 3608 Ave. A.

UTAH

Utah: 1944. Hdqrs., Salt Lake City. Meets, 3rd Thurs. PRES, R. C. Evans, 2549 Wilmington Ave. (6). SECY, G. E. Wright, Jr., Dooly Bldg.

VIRGINIA

Virginia: 1946. Hdqrs., Norfolk. Meets, 3rd Wed. PRES, C. G. Conaway, Jr., 7454 Hana Ave. (5). SECY, E. R. Simpson, Jr., 720 Guy St.

WASHINGTON

Inland Empire: 1950. Hdqrs., Spokane. Meets, 1st Mon. PRES, F. W. Jenkinson, W. 524 Fourth Ave. (4). SECY, J. A. Doyle, W. 3018 Broad.

Pacific Northwest: 1928. Hdqrs., Seattle. Meets, 2nd Tues. PRES, P. I. L. Winsor, 20031 Marine View Dr., S.W. (66). SECY, M. W. McKinstry, 4017 McGilvra St. (2).

WISCONSIN

Wisconsin: 1922. Hdqrs., Milwaukee. Meets, 3rd Mon. PRES, I. J. Rossiter, 231 W. Wisconsin Ave. (3). SECY, R. D. Rodwell, 152 W. Wisconsin Ave. (3).

CANADA

British Columbia: 1952. Hdqrs., Vancouver. Meets, 2nd Wed. PRES, Cornelius Van Boeyen, 636 Drake St. (3). SECY, A. C. Martin, 425 W. Second Ave.

Manitoba: 1935. Hdqrs., Winnipeg. Meets, 4th Thurs. PRES, G. C. Davis, 212 Waverly St. (9). SECY, A. H. Millar, 342 Mandeville St., St. James (12).

Montreal: 1936. Hdqrs., Montreal. Meets, 3rd Mon. PRES, R. J. Ker, 5000 Namur St. (9). SECY, W. E. Jarvis, P.O. Box 61.

Northern Alberta: 1956. Hdqrs., Edmonton. PRES, W. C. Woods, 13906 116 Ave. SECY, E. K. Cumming, 10249 104 St.

Ontario: 1922. Hdqrs., Toronto. Meets, 1st Mon. PRES, D. L. Angus, 25 Bayview Wood. SECY, H. R. Roth, 57 Bloor St., W.

Ottawa Valley: 1952. Hdqrs., Ottawa. Meets, 3rd Tues. PRES, L. J. Schoenherr, 32 Clarey Ave. (1). SECY, C. W. Watson, 102 Bank St.

SPECIAL BRANCH

Switzerland: 1952. Hdqrs., Zurich. PRES, Walter Hausler, Erbstrasse 2, Kusnacht. SECY, L. F. de Bruyn, Muhlebachstrasse 172 (8).

STUDENT BRANCHES

North Carolina State College: 1948. Hdqrs., Raleigh. PRES, R. E. Crawford, 106½ Logan Ct. SECY, S. R. Moore, Box 4317, State College.

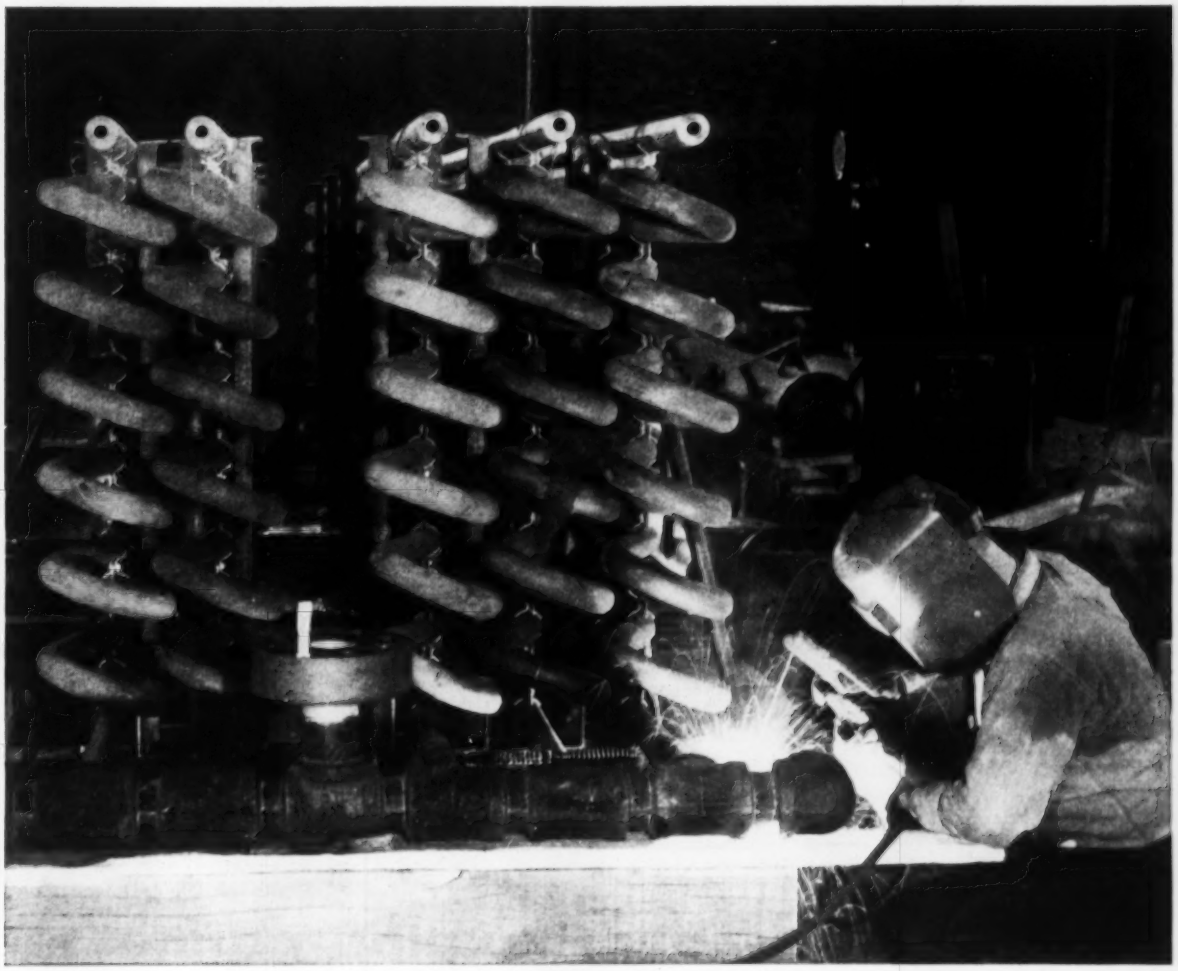
Oregon State College: 1949. Hdqrs., Corvallis. Meets, 1st Wed. after 1st Tues. PRES, P. I. Anderson, 202 N. 10th. SECY, D. W. Strahan, 233 Mall St.

Purdue University: 1948. Hdqrs., W. Lafayette, Ind. PRES, D. B. Doucette, Purdue Student Branch, ASHAE, School of Mech. Engrg. SECY, J. W. Deabler, Purdue Student Branch, ASHAE, School of Mech. Engrg.

Texas A. & M. College: 1946. Hdqrs., College Station. Meets, 2nd and 4th Tues. PRES, D. F. Carroll, Box 6264. SECY, C. W. Farrar, Jr., Rt. 1, Box 339, Bryan.

University of Detroit: 1949. Hdqrs., Detroit. Meets, 1st Tues. PRES, L. J. Hayes, Jr., 16254 Santa Rosa Dr. (21). SECY, E. F. Hoelscher, Jr., 14283 Cherrylawn (38).

University of Toronto: 1951. Hdqrs., Toronto. PRES, C. F. Smale, 347 Kennedy Ave. (9). SECY, T. D. Digel, 204 King St., Weston.



Putting the Chill on NH_3

The Vilter Manufacturing Co. of Milwaukee, Wis., makes, among other interesting and useful products, ammonia (NH_3) synthesis coolers. These coolers must contain the newly-made hot gas at a pressure of 10,000 psi and reduce its temperature by means of cooling water conducted over the tubes.

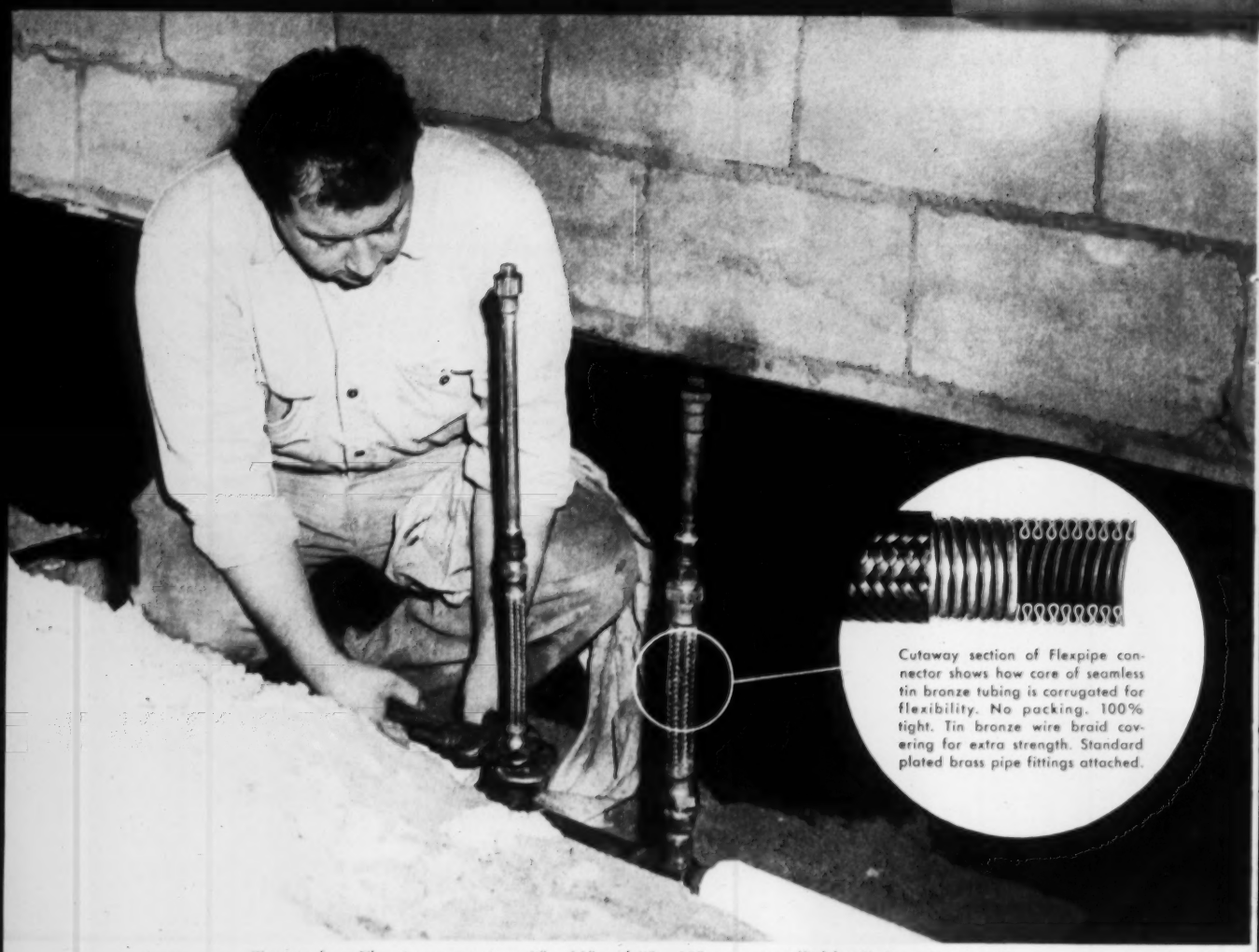
To meet its exacting requirements, Vilter chose B&W Seamless Tubing, made for high-pressure service. All tubing in these coolers is tested at 15,000 psi.

To bend these heavy-wall tubes to a 4″ radius, 3⅛″ off the vertical plane, is evidence of Vilter's skill and craftsmanship at work.

And for evidence of how B&W tubing can help improve your own skill and craftsmanship, get in touch with Mr. Tubes, or write for Bulletin 408. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pa.

TA6032-P

Seamless and welded tubular products, seamless welding fittings and flanges—in carbon, alloy and stainless steels


Cutaway section of Flexpipe connector shows how core of seamless tin bronze tubing is corrugated for flexibility. No packing. 100% tight. Tin bronze wire braid covering for extra strength. Standard plated brass pipe fittings attached.

Twenty-four Flexpipe connectors, ¾" x 11" and ½" x 10", were installed by DeRosa Heating Co. between main below concrete slab to radiators above floor in new shopping center near Utica, N. Y.

"We installed new Flexpipe connectors to eliminate leaks in hot water system,"

reports Andy DeRosa, DeRosa Heating Co., Utica, N. Y.

"The ease of installation and prospect of no call backs for repairs sold us on the use of Flexpipe* flexible connectors for this wet heat system," adds Mr. DeRosa.

"Flexpipe eliminates the time and materials cost of rigid connections made up of elbows, couplings and short runs of pipe. And its flexibility lessens the possibility of breakage and leaks due to expansion."

USE FLEXPIPE TO PERMIT TRAVEL . . . ABSORB VIBRATION . . . CONNECT MISALIGNED PORTS IN PIPELINES

SERVICE. Flexpipe assemblies can be used to convey air, gas, oil, steam or water. They're easy to install in cramped spaces . . . need no attention once installed. Flexpipe installations dampen noise in piping, take care of expansion and contraction, are long lasting.

WHERE TO BUY. Flexpipe connectors come in convenient standard sizes, and are sold only by leading wholesale distributors. Distributors can show you samples and answer questions about service applications. For the name and address of the one serving your area, or for more detailed information, write to: The American Brass Company, American Metal Hose Division, Waterbury 20, Conn. In Canada: The Canadian Fairbanks-Morse Company, Ltd.

*Trade Mark

FLEXPIPE — STANDARD SIZES

I.D.	Max. Offset each side of C/L (intermittent travel)	Over-all Length Inches	Part Numbers	Max. Working Pressure at Room Temp. PSI	Max. Working Pressure at Max. Temp. (350° F) PSI
¼	½ 1¼	8 16	¼ M-10 ¼ M-20	1200	850
⅜	½ 1¼	9 18	⅜ M-10 ⅜ M-20	1000	700
½	½ 1¼	10 20	½ M-10 ½ M-20	750	525
¾	½ 1¼	11 22	¾ M-10 ¾ M-20	600	425
1	½ 1¼	12 24	1 M-10 1 M-20	550	375
1¼	½ 1¼	13 26	1¼ M-10 1¼ M-20	300	200
1½	½ 1¼	14 28	1½ M-10 1½ M-20	275	175
2	½	18	2 M-10	200	125

Flexpipe an **ANACONDA**® product

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Mechanical Engineer: E. GRITSCHKE & ASSOCIATES
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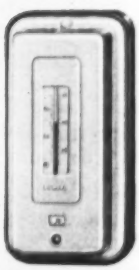
Thermostatic Control System helps provide comfortable atmosphere for learning

"This million dollar building is unique in the annals of architectural school buildings," comments Director Bush-Brown, "in that the State of Georgia has provided for all needs in a building designed and supervised by those who will occupy it—members of the architectural staff."

The large drafting room above has a mezzanine with individual study cubicles. Auditorium and lecture room is air conditioned as is the library which preserves books and makes for year 'round comfort. Other spaces include classrooms, offices, gallery below and rooms used for judgments and exhibitions.

Consult Powers on your temperature and humidity control problems. Experience we have gained in thousands of significant buildings may be helpful to you.



25 to 50 Years of Dependable Operation with a minimum of repairs and maintenance is often reported by users of Powers control.

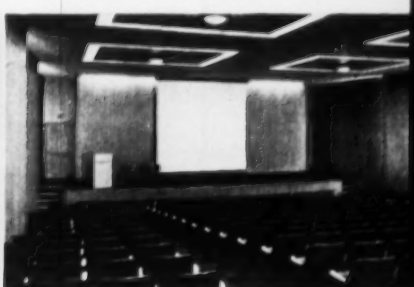
POWERS CONTROL

(c67)

THE POWERS REGULATOR COMPANY

SKOKIE, ILLINOIS | *Offices in Chief Cities in U.S.A., Canada and Mexico*

65 Years of Automatic Temperature and Humidity Control



This One is 100% Efficient on Chickens — but 0% on Mice!

SO— when you compare filter efficiencies, use the same test

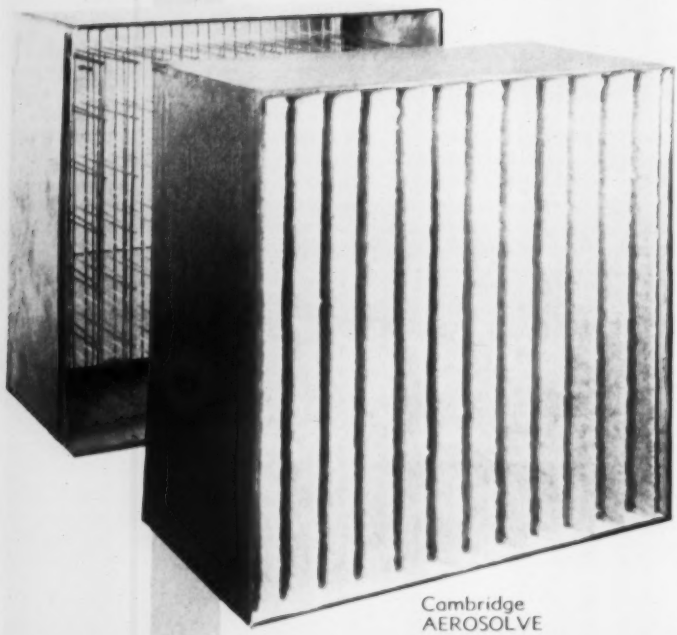
STANDARD TESTS — PERCENTAGE OF EFFICIENCY

TYPE FILTER	ASHAE (Weight Test)	NBS TEST # (Atmospheric Dust)	DOP TEST (0.3 Micron Smoke)
Cambridge Absolute	*	*	**99.95 Min.
Cambridge Aerosolve 95	*	90-95	80-85
Cambridge Aerosolve 85	99	80-85	50-60
Cambridge Aerosolve 35	96	30-35	20-30
Electric Precipitator	99	85-90	60-70
2" Cleanable	76	8-12	2-5
2" Throwaway	76	8-12	2-5

*Practically 100%. Test not practical for more accurate reading.

#National Bureau of Standards Discoloration Test.

**Maximum Allowable Penetration of Dioctyl Phthalate Smoke 0.05%. Every filter individually tested.



Cambridge AEROSOLVE Filter

Cambridge filters, used alone or with pre-filters to take out the "chickens," give you high-efficiency air cleaning at only a fraction of previous costs. Wide range of efficiencies, from the Cambridge AEROSOLVE 35 to the world-famous Cambridge ABSOLUTE.

Cambridge AEROSOLVE Filters have a rugged permanent frame for long life. Light, compact cartridges, in a wide range of efficiencies, provide long service life and are easily replaced. No maintenance required.

Take advantage of Cambridge's unequalled experience in the field of high-efficiency air filtering. Ask the Cambridge man to help you lick your tough filtering problems.

Write for
AEROSOLVE Filter Bulletin 105A
ABSOLUTE Filter Bulletin 106A

CAMBRIDGE FILTER CORP.

Pioneers in High-Efficiency Air Cleaning

734 E. Erie Blvd. Syracuse 3, N. Y.

Representatives in Principal Cities

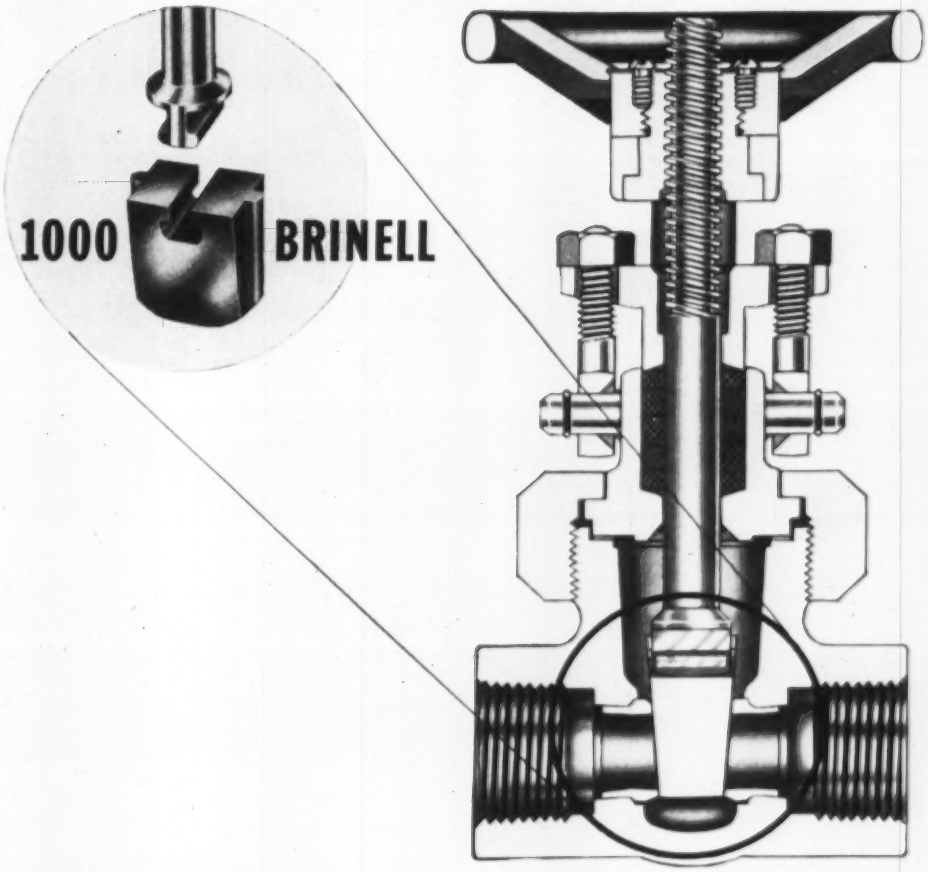


Fig. 1221

Stop Galling with the hardest valve wedges you can buy

Especially suited for high temperature hot water heating

Here's a wedge as hard as flint . . . so hard that it's undamaged by pipe cuttings, scale or grit. It's the only trim we know of which will successfully withstand the simultaneous attack of the three valve-destroying agents—corrosion, erosion, galling. This wedge is *13% chrome stainless steel hardened up to 1000 Brinell.*

Specify the OIC 1221 gate or 1621 globe where you need the extra rugged nature of forged steel. They are recommended for steam service up to 800°F., oil service up to 1000°F. Or, use these same valves for hydraulic service up to 2000 lbs.

Write for Form 195 for specifications on the OIC forged steel line.

OIC VALVES | FORGED & CAST STEEL, LUBRICATED PLUG, BRONZE & IRON VALVES

THE OHIO INJECTOR COMPANY
WADSWORTH, OHIO

Insist on the New *Classic* Thermostat...

Get Accurate Heating Control
Attractive, Modern Styling
Easy, Inexpensive Installation

***Install* DETROIT CONTROLS'**

***New Classic* Thermostat**

for Customer Satisfaction!

The Classic will add style and saleability to the heating systems you manufacture, sell or install.

Its smart, modern design will complement the decoration of any home, new or old. The single, large numbered dial is slanted for perfect vision—can be read at a glance! The temperature selector is directly under the indicator needle—eliminates fumbling with old-fashioned turning or twisting devices.

Installation is very simple. No precision levelling is necessary. The Classic requires only two wires—easily replaces any two or three wire thermostat of earlier design.

Close control of any type heating, within a *fraction of a degree,* is assured by Detroit Controls' Timed Cycling function.

National advertising in Better Homes & Gardens, Small Homes Guide, Home Modernizing and other magazines will bring broad consumer acceptance to the Thermostyled Classic.

Take Advantage of this opportunity...

SELL THE *Classic*

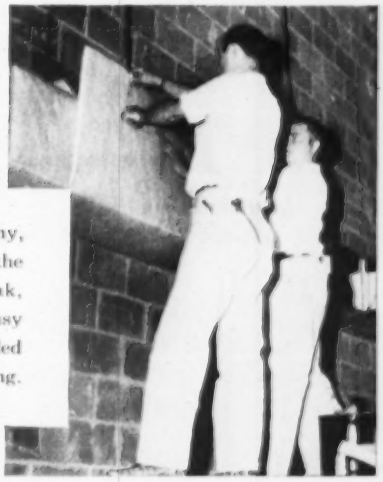
DETROIT CONTROLS
CORPORATION

5900 TRUMBULL AVE. • DETROIT 8, MICHIGAN
Division of AMERICAN RADIATOR & STANDARD SANITARY Corporation

Representatives in Principal Cities · Canadian Representatives:
RAILWAY AND ENGINEERING SPECIALTIES, LTD.
Montreal, Toronto, Winnipeg

AUTOMATIC CONTROLS for DOMESTIC HEATING • AIR CONDITIONING • REFRIGERATION • AVIATION • TRANSPORTATION • HOME APPLIANCES • INDUSTRIAL USES

INSULATION news from L·O·F GLASS FIBERS COMPANY



Wayne Johnson, of Johnson Insulation Company, used Super-Fine to insulate ducts for the Northwood Shopping Center in Royal Oak, Michigan. He found Super-Fine lightweight, easy to handle and cut—yet so strong it could be pulled between the ducts and walls without tearing.

Super·Fine's low installation cost means big business for contractors!

Fast installation combined with high insulating efficiency can clinch the contract for you.

Super-Fine's millions of fine glass fibers form countless dead air cells which provide highly efficient insulation. It is pleasant to handle—fast and easy to apply. It cuts readily with an ordinary knife, needs no special measuring or fitting, can quickly be wrapped around ducts and supporting hangers. Contractors find that workmen can apply more Super-Fine per day than other types of insulation.

You save on storage space, too, because Super-Fine comes in compressed rolls up to 72" wide, in all standard thicknesses and roll lengths. They take up less space, yet the insulation springs back to full thickness when unrolled.

There's big business ahead for you when you discover how Super-Fine can help you save on duct-application costs. Check your Yellow Pages for the nearest distributor or write: L·O·F Glass Fibers Company, Dept. 39-56, 1810 Madison Avenue, Toledo 1, Ohio.

LOF GLASS FIBERS
SUPER-FINE INSULATION

L·O·F GLASS FIBERS COMPANY

TOLEDO 1, OHIO

Makers of glass fibers by the exclusive "Electronic Extension" process

The NO-COMPROMISE

HEATING-COOLING COMBINATION

Webster Tru-Perimeter Forced Hot Water Baseboard Heating with compatible Warren Webster Cool Air System

In a Philadelphia suburb, these 85 Webster-heated Webster-cooled ranch homes at less than $15,000 point the way to year-round comfort in a quality house — without any compromise, winter or summer. Two completely independent, completely compatible systems — each providing unsurpassed comfort — give the builders of Stanwood Homes an advantage equalled only in costly custom-built dwellings.

At Stanwood, Webster Tru-Perimeter Forced Hot Water Baseboard Heating provides winter-long, draft-free comfort at low fuel cost. Installation is easy and economical . . . heating is installed after plastering.

And at Stanwood, Warren Webster Cool Air System gives summer-long comfort in rooms requiring cooling. Cooler utilizes glass fiber supply and return ducts, and a single plenum chamber of vaporproof insulation board. Ducts are easy and inexpensive to install. Registers, with dampers, give complete control of cool air distribution to each room. Central thermostat permits choice of full cooling in hot weather; fan-circulated filtered air in mild weather; complete shut-down in cool weather.

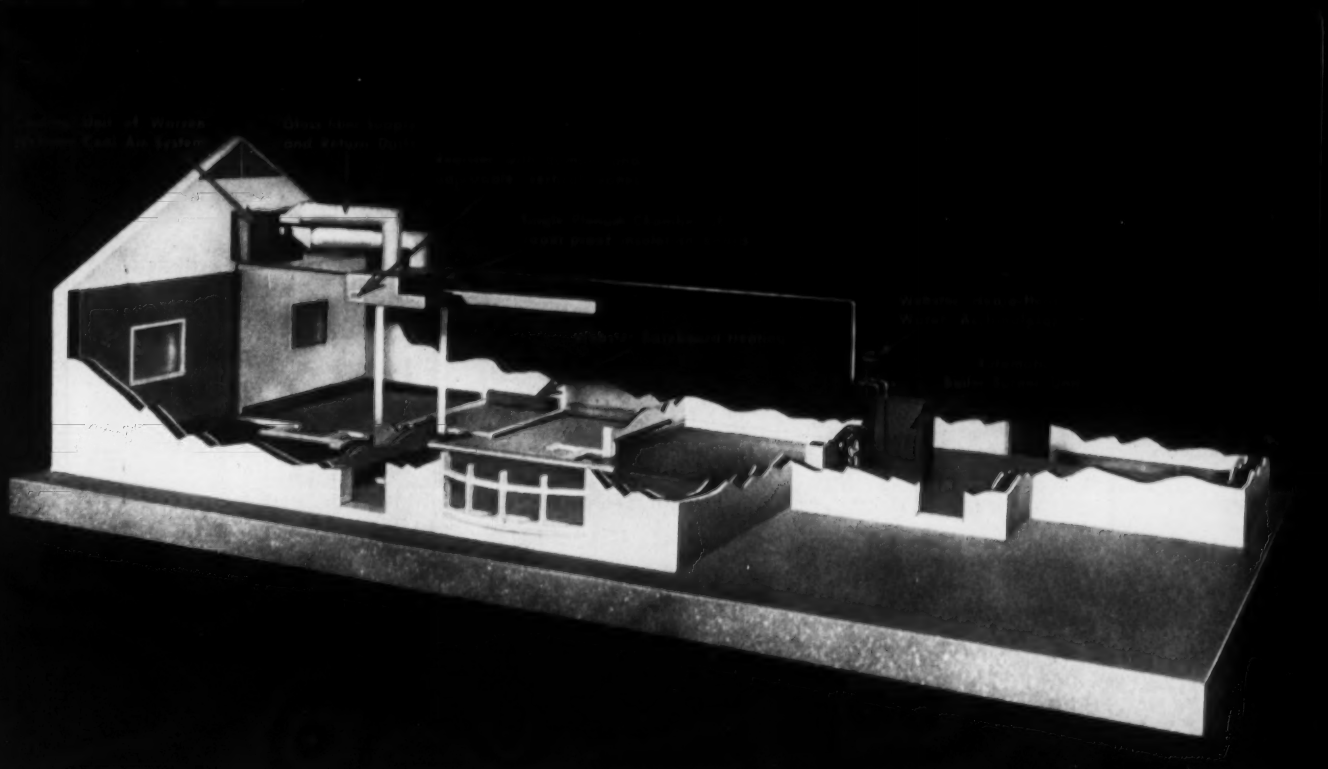
For information on Webster Baseboard Heating with compatible Warren Webster Cool Air System, see your Webster Representative, or write us.

Address Dept. HP-5

WARREN WEBSTER & COMPANY
Camden 5, New Jersey : : Representatives in Principal Cities
In Canada, Darling Brothers, Limited, Montreal

WARREN
Webster
HEATING & COOLING EQUIPMENT

LOCATED NEAR YOU — TO HELP YOU. Webster Representatives in these 66 U. S. Cities: Albany, Atlanta, Atlantic City, Baltimore, Bethlehem (Pa.), Birmingham, Boston, Buffalo, Butte, Charleston (W. Va.), Chattanooga, Chicago, Cincinnati, Cleveland, Columbia, Columbus, Dallas, Davenport, Dayton, Denver, Des Moines, Detroit, Grand Rapids, Harrisburg, Houston, Indianapolis, Kansas City, Kingston (Pa.), La Porte (Ind.), Little Rock, Los Angeles, Louisville, Lubbock, Memphis, Milwaukee, Minneapolis, Nashville, Newark, New Haven, New Orleans, New York, Oklahoma City, Omaha, Orlando, Philadelphia, Pittsburgh, Portland, Raleigh, Richmond, Roanoke, Rochester, Saginaw, St. Louis, Salt Lake City, San Antonio, San Francisco, Seattle, Spokane, Springfield (Mass.), Syracuse, Toledo, Trenton, Tulsa, Washington, Wichita, Wilmington . . . In Canada, Darling Brothers Ltd., Montreal.



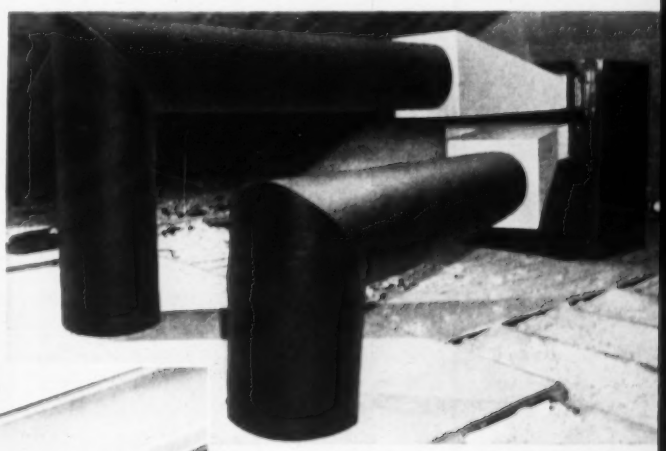
Model of Stanwood Home, Croydon, Pa., displayed at NAHB Show in Chicago. Shows independent Webster heating and cooling systems teamed smoothly for year-round comfort. Builder: Stanwood Corporation, Philadelphia. Project Manager: Glace & Glace, Inc., Harrisburg, Pa. Heating and Air Conditioning Contractor: Max Weiner & Sons, Philadelphia.

Cooling Comfort Advantages of Warren Webster Cool Air System:

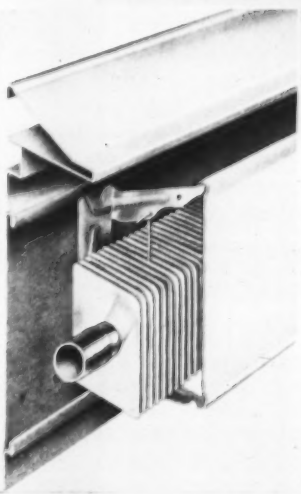
Cooling system completely independent of heating system
Ducts specifically designed for cooling only
Separate thermostatic controls for cooling and heating
Simple and quick installation – integral insulation and vapor seal
Air-cooled equipment in adequate range of sizes
Not a "room cooler"—Webster System cools entire house.

Heating Comfort Advantages of Webster Baseboard Heating:

Forced hot water spreads clean, quiet, gentle heat along exposed walls
Heating is uniform and draft-free
No baked heat concentrations, no "smell" of heat
Gives comfort, even beside large windows
Controls provide easy regulation of heat delivery
Wasteful overheating avoided
Low fuel cost . . . economical maintenance
Permits complete freedom in furniture arrangement



Installation of Warren Webster Cool Air System, showing cooling unit with hermetically sealed refrigeration cycle and glass fiber supply and return ducts leading to plenum chamber.



Cut-away view of Webster Baseboard Heating, showing heating element of finned copper tubing behind metal baseboard. Note its simplicity.

Bethcon bends flat without flaking

Yes, you can actually bend Bethcon double without flaking off the zinc coating. That's because Bethcon is galvanized by a continuous process which bonds the zinc to the base steel much more tightly than conventional methods.

This is one of the advantages of Bethcon which has caused sheet-metal contractors to call for increasing supplies of this remarkable galvanized sheet. There are other advantages, too, which will interest both you and your customers.

For instance, Bethlehem's continuous galvanizing process distributes the zinc more evenly, and eliminates the heavy beads usually found on the drip ends of hot-dipped sheets. Then, too, you can have Bethcon in coil lengths as well as cut sheets. And the smaller, brighter, more uniform spangles are bound to be far more attractive to your customer's eye.

You can specify Bethcon in any gage from 14 on up, in plain steel or copper-bearing for extra corrosion-resistance. If you have not yet worked with Bethcon, you might like to talk with someone who has. If so, we'll gladly give you the name of such a contractor who is located somewhere near you. Or if you'd prefer to discuss it with one of our own men, just get in touch with the nearest Bethlehem district sales office.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

Shows how to solve duct liner equations without a slide rule!

"How much of this duct should I line to attenuate 15 db of fan noise?"

Common problems like this can easily be solved when you have Gustin-Bacon's new 8-page brochure on Ultralite Duct Insulation and Duct Liner. And you won't need a slide rule — because Gustin-Bacon has plotted for you the values for $12.6a^{1.4*}$ power at various absorption coefficients, as well as giving you the sound absorption coefficients of Ultralite Duct Liner at various frequencies. In addition, this new brochure will show you a new easy way to solve the problem of lining ducts that are not long enough to obtain the required decibel reduction.

The new booklet also contains a wealth of helpful information about Ultralite Duct Insulation and Duct Liner. You'll find specifications and instructions for insulating heating ducts . . . cooling or combination ducts . . . forming duct liner with the metal . . . applying surface finishes, both indoors and out. This information makes it easier for you to specify and apply Ultralite than any other duct insulation on the market. Ultralite is the only insulation of long glass fibers . . . the first flexible glass fiber duct insulation on the market . . . the easiest and most economical duct insulation you can use. Get the facts from your nearby distributor, or write today.

WRITE TODAY FOR YOUR FREE COPY

*Equation on pg. 942 of 1955 American Society of Heating, Ventilating & Air Conditioning Engineers Guide or in Gustin-Bacon's new Duct Brochure.

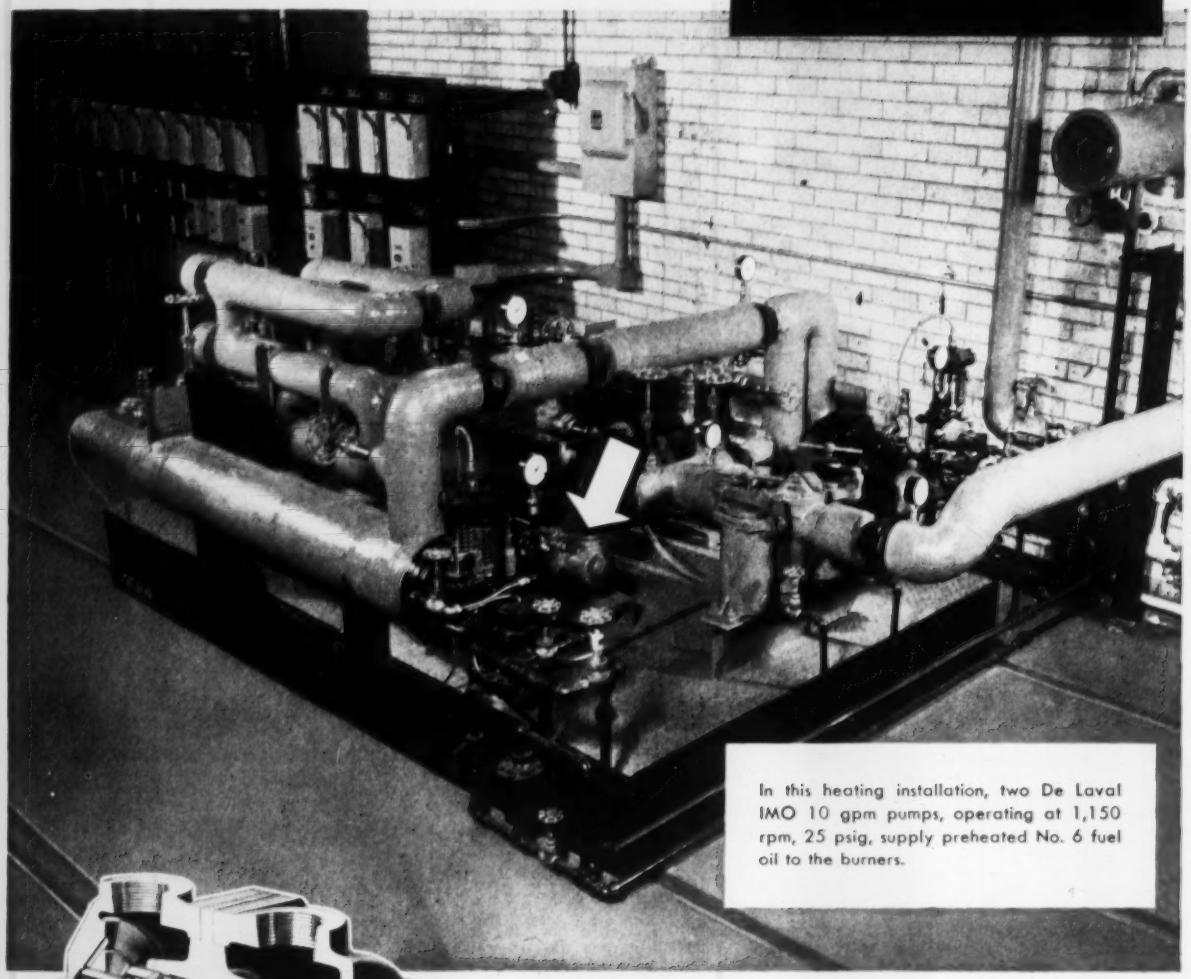
GUSTIN-BACON *Manufacturing Company* GUSTIN gb BACON

Thermal and acoustical glass fiber insulations • Pipe couplings and fittings • Molded glass fiber pipe insulation

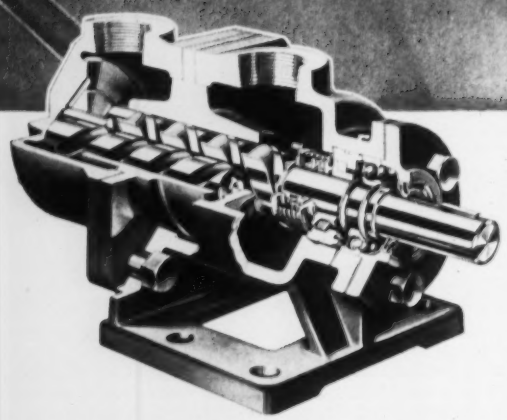
220 W. 10th St., Kansas City, Mo.

Contracts are more profitable when you install dependable

DE LAVAL
IMO PUMPS



In this heating installation, two De Laval IMO 10 gpm pumps, operating at 1,150 rpm, 25 psig, supply preheated No. 6 fuel oil to the burners.



A wide range of De Laval IMO models specifically built for fuel oil service is available. Capacities up to 80 gpm, pressures to 275 psig. Write today for Bulletin LG-A.

To increase your present—and future—profits on commercial heating jobs, install *dependable* De Laval IMO pumps on pump and heater sets. Their simple, trouble-free design saves you money on service calls . . . builds customer goodwill, for there's nothing to get out of order or need adjustment. No pilot gears, no sliding vanes, no reciprocating pistons. De Laval IMO's have only three moving parts—smoothly intermeshing rotors that propel the fluid axially in a steady flow without churning, pocketing or pulsation.

DE LAVAL *IMO Pumps*

DE LAVAL STEAM TURBINE COMPANY
821 Nottingham Way, Trenton 2, New Jersey

DL 272

SAVES 50% ON CLEAN AIR MAINTENANCE COSTS!

THE FIRST TOTALLY NEW FILTER DEVELOPMENT . . . IN 25 YEARS

"This is not an idle claim . . . it's a fact . . . PROVEN UNDER ACTUAL INSTALLATION AND MAINTENANCE CONDITIONS.

Make no mistake about it . . . no matter how small your filter requirements . . . or how large, here is a completely new air filter development that can absolutely cut your clean air maintenance costs in half.

NO HEAVY TENSION OIL—Evans filters do not have a messy, sticky type of adhesive that is filthy to handle and difficult to clean. It is unnecessary and is forbidden in the use of Evans filters.

CLEAN WITH TAP WATER—Evans filters can be cleaned clean in minutes with nothing ever but tap water sprayed through an ordinary garden hose nozzle. They require no expensive fireproof room. No caustic cleaning solutions or agents. This eliminates all danger in the cleaning of Evans filters.

LIGHT WEIGHT CUTS LABOR COSTS—Evans filters are all aluminum. Light to handle, to carry, to pick up. In spite of airtight fitting frames, Evans filters pull quickly and easily in and out of the frames. Take much less effort, less labor to handle. No latches . . . or lugs required.

REMEMBER: Initial costs for air cleaning equipment are not the big factors or controlling factors in the cost for clean air.

IT'S OPERATING COSTS THAT YOU MUST LIVE WITH AND THAT YOU MUST CONTROL.

EVANS FILTERS GIVE YOU THAT CONTROL. MAKE IT POSSIBLE FOR YOU TO SAVE 50% ON CLEAN AIR MAINTENANCE COSTS.

- ALL ALUMINUM
- EVERY PART PRECISION MADE
- HOLD UP TO 200% MORE DUST AND LINT WITHOUT HARMFUL RESTRICTION TO AIRFLOW
- GIVES LIFETIME SERVICE

FREE CATALOG

MAIL COUPON TODAY

THE GEORGE EVANS CORPORATION • MOLINE, ILLINOIS

Gentlemen: I wish to know how to cut my clean air maintenance costs in half with a filter that gives lifetime service. Please send me new illustrated catalog.

Name.....

Company.....

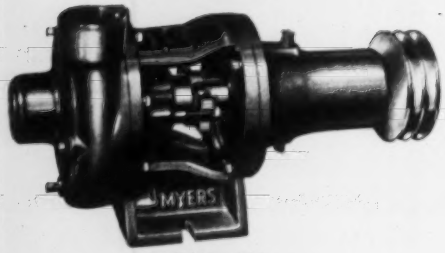
Address.....

City.....State.....

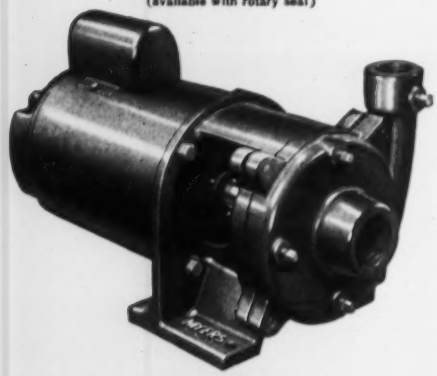
Evans

Lifelong AIR FILTERS

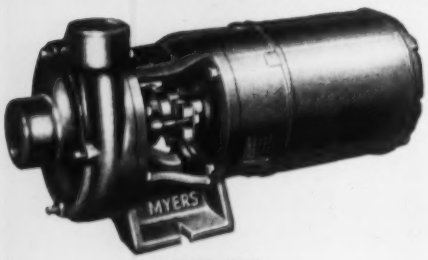
MODEL 100-B
Rotary seal only



MODEL 125-B
Shown with stuffing box
(available with rotary seal)



MODEL 100-M
Rotary seal only



MODEL 125-M
Shown with stuffing box
(available with rotary seal)

A Complete Line of Centrifugals for Air Conditioning from

MYERS

tops in pumps since 1870

FULL RANGE OF SIZES
⅙, ½, ¾, 1, 1½, 2, and 3 horsepower, motor-mounted or belt-driven models.

TWO CASING SIZES
1″ x 1¼″ or 1¼″ x 1½″.

ALL-BRONZE IMPELLER
Accurately balanced for smooth operation.

REMOVABLE BRONZE WEARING RINGS
Easily replaced for longer pump life.

ROTARY SEAL
Eliminates leakage (stuffing box may be specified on "125" models).

CORROSION-RESISTANT SHAFT
Stainless steel for trouble-free service.

WIDE RANGE OF CAPACITIES AND HEADS
Capacities to 90 GPM. Heads to 135 feet.

Write today *for Bulletin 210 on* Myers *Centri-Thrift Pumps.*

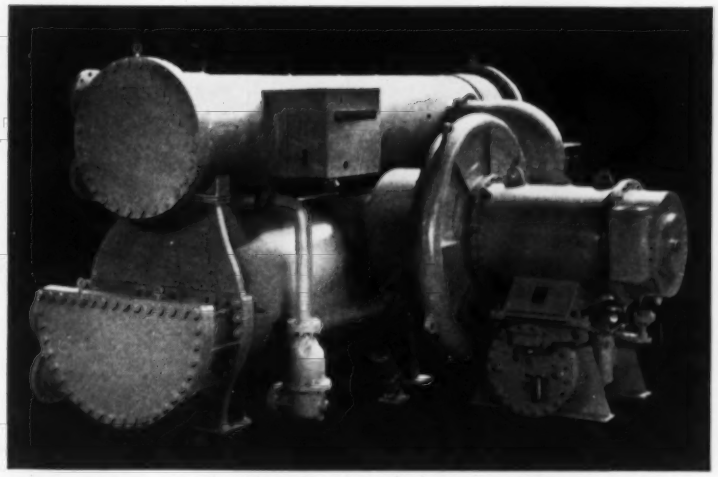
Myers

PUMPS WATER SYSTEMS AND WATER SOFTENERS

The F. E. Myers & Bro. Co., Ashland, Ohio

Cuts cooling, installation, and maintenance costs!

SINGLE-STAGE TONRAC® INSTALLS ON ONE LEVEL



American Blower Tonrac automatically maintains chilled-water temperature, *regardless of load!* Requires no built-up bases.

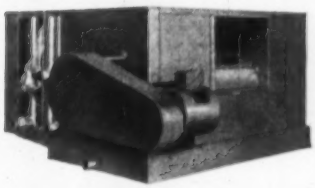
An advanced-design, hermetic centrifugal refrigerating machine — Tonrac comes complete, ready for installation on *one* level. No build-up bases, flexible couplings, or speed-increasing gears are needed: The single impeller is directly driven by a constant-speed 3600 rpm motor. Saves weight, space, installation costs!

Tonrac cuts operating and maintenance costs, too, for it achieves compression in *one* stage . . . allowing two-bearing construction, and eliminating compression losses and power waste that are common with multi-stage units. This single-stage, hermetic design — with its inherent simplicity and few moving parts — assures quieter operation: makes even the roof an ideal location for Tonrac!

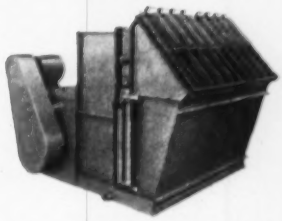
For full facts, call our nearby representative. Or write direct for Bulletin 1426.

Packaged Air Conditioners for offices, stores, industrial plants, and similar applications. Cools without chilling. 3- thru 20-ton capacities.

American Blower equipment answers all your air conditioning needs



Central-Station Air Conditioners



Multi-Zone Air Conditioners

American Blower offers a complete product line, designed and engineered to meet the exact specifications of your air conditioning requirements. Call on us, today, and pinpoint equipment responsibility for your entire system!

American Blower products serve industry

- Air Conditioning, Heating, Ventilating Equipment
- Mechanical Draft Fans
- Industrial Fans and Blowers
- Centrifugal Compressors
- Gyrol Fluid Drives
- Dust Collectors
- Refrigerating Machines

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of American-Standard

AMERICAN BLOWER

Air conditioning equipment for every business

TURNING POINT FOR SMOOTH, SILENT PERFORMANCE IN...

Air Conditioning

RUBBER MOUNTED CARTRIDGE

RUBBER MOUNTED FLANGE

RUBBER MOUNTED PILLOW BLOCK

SEALMASTER

BALL BEARING UNITS

PILLOW BLOCK

TWO-BOLT FLANGE

FOUR-BOLT FLANGE

SEALMASTER

BALL BEARING UNITS

Smoother, quieter performance is the aim of every air conditioning manufacturer. SEALMASTER Ball Bearing Units with their exclusive combination of features are a major step in achievement of that goal. There's no surer way of adding quality and smooth, quiet performance to the air conditioning equipment you manufacture. The key to SEALMASTER'S added quality and performance are found in this exclusive combination of features.

ZONE HARDENING assures positive race to shaft holding power, minimizing vibration, eliminating shaft wear and reducing fretting corrosion.

LAND RIDING BALL RETAINER traps grease and prevents "churning"

LABYRINTH SEAL keeps dust and dirt out, lubrication in

LOCKING PIN AND PERIMETER DIMPLE prevents creep or spin of outer race ring in housing, eliminating housing wear, but permitting alignment of shaft and bearing unit.

Write for full information on these features and Bulletin 1253 on SEALMASTER Rubber Mounted Bearing Units for the Air Conditioning Industry.

BULLETIN 1253

SEALMASTER BEARINGS A DIVISION OF STEPHENS-ADAMSON MFG. CO. • 47 RIDGEWAY AVE., AURORA, ILLINOIS

America's most beautiful gas unit heater...

the *Magnificent*

Modine

a new concept in styling and performance sets pace in gas-fired unit heating

Beautiful... to be sure! But there's more to the new Modine than meets the eye

Here at last is a gas unit heater so strikingly beautiful it can be installed with pride in the finest commercial, institutional and industrial buildings. Truly distinctive lines and attractive soft green finish are accented by sparkling medallion, grilles and panel of polished chrome. Yes, the new Modines are in a class by themselves — thanks to the skill of famous designer Jean Otis Reinecke.

And the new Modines are as great as they look . . . in performance, economy and safe, trouble-free operation. Check these unmatched benefits:

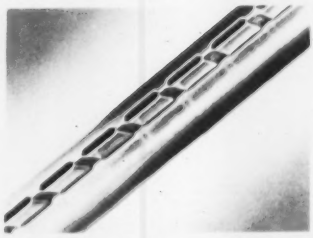
New performance — Improved stainless steel burners and choice of stainless or aluminized steel heat exchangers, with combustion air inlets located directly below, increase heating efficiency, minimize corrosion.

Quieter operation — Lower speed motors, new fan design and resilient motor mounting assure quieter operation at full capacity heat delivery . . . provide ample heat throw to all areas without hot blasts.

Lighter weight — Actual comparisons show the new Modines to be *up to 50% lighter* than other makes. They are easier to install, cost less to ship and handle.

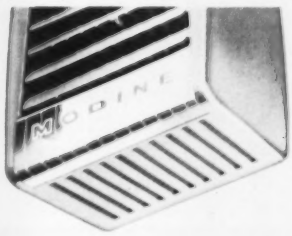
Wider range of sizes — The new Modines are available in eight sizes now, ranging from 25,000 to 310,000 Btu. There's a size for every application of natural, manufactured, mixed, LP and LP air gases.

For full particulars, see your nearest wholesaler or the Modine representative listed in your phone book. Wholesaler franchises still open in some areas.



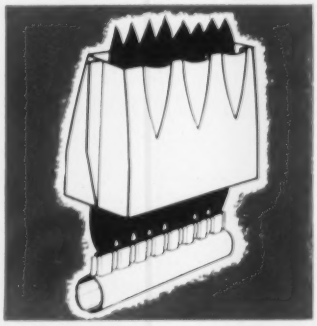
SELF-CLEANING PORTS

Knife-sharp stainless steel ports have four times the free area of drilled ports. Keen edges resist lodging of dirt and scale, maintain uniform flame.



IMPROVED COMBUSTION

Hooded combustion air inlets directly below each tube assure higher burning efficiency, minimize flame disturbance.



FASTER, MORE UNIFORM HEAT

Continuous, uniform flame from front to rear of individually and directly-fired tubes boosts radiant heat absorption and uniform heat distribution.

SAFETY MEASURE

Sturdy guard protects against hazards of exposed fan and provides resilient suspension for motor and fan assembly, further reducing vibration noises.

BIG SIZES, SMALL PACKAGES

This 25,000 Btu Modine gas unit heater weighs only 35 lbs. New Modines are ideal for factories, offices, laboratories, washrooms, garages, service stations, stores.

CLIP THIS COUPON AND MAIL TODAY

MODINE MFG. CO.
1500 DeKoven Ave., Racine, Wis.

Please send me immediately a free copy of new bulletin, "The Magnificent Modine Gas-Fired Unit Heater."

Name .....

Firm .....

Address .....

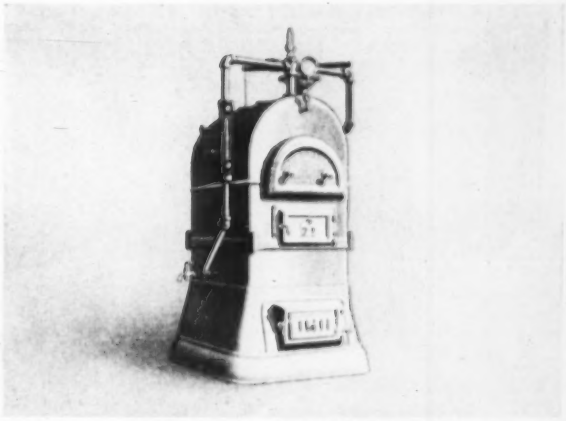
City ..... Zone ..... State .....

G. U. 1306

Modine
GAS UNIT HEATERS

If you are thirty...

AND INTEND TO LIVE TO BE EIGHTY-FIVE



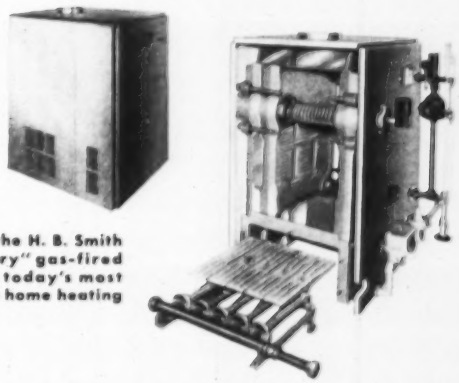
This is the type of H. B. Smith boiler which has served Mr. Bishop since 1901.

The Boiler to Buy is an H. B. SMITH

Why? Well, if history proves anything, the H. B. Smith boiler you install today is quite likely to be the last one you'll ever have to buy! . . . (yes, we do a poor repeat business!).

Take the case of Mr. Frank E. Bishop, 85, of Clarksburg, Massachusetts. Back in 1901, when *he* was thirty, he had an H. B. Smith boiler installed in his home. Although his neighbors have used two or more boilers of other makes since that time, Mr. Bishop continues to enjoy year-in, year-out warmth and comfort provided by his original H. B. Smith unit.

Mr. Bishop's boiler bears little resemblance to today's H. B. Smith home heating plants. But the cast iron unit embodied sound engineering, now so refined in design, material and workmanship that *your* chances of using an H. B. Smith boiler for 55 years are *vastly* improved.



This is the H. B. Smith "Century" gas-fired boiler, today's most modern home heating plant.

And in addition to long life, H. B. Smith cast iron boilers offer many other advantages: their economy of operation, negligible maintenance expense, ease of conversion to different fuels, and ready expansibility bring their owners heat and hot water at *low cost year after year!*

H.B. Smith **CAST IRON BOILERS**

H. B. SMITH CO., INC., WESTFIELD, MASSACHUSETTS • *Established 1853*

For HEATING, VENTILATING and AIR CONDITIONING

NEW...

WESTINGHOUSE AIR HANDLING COMBINATION UNITS in 13 basic sizes give you Unlimited Selection...

The most complete line for every job—Westinghouse Air Handling Combination Units handle from 500 to 48,500 CFM.

These versatile units, each with a choice of two coil face areas; in five coil types (see panel at right) and accessories as required, permit you to select from the broadest line in the industry.

Only Westinghouse Gives You:

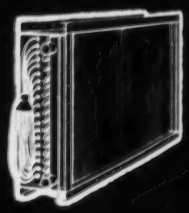
- High Efficiency
- Quiet Operation
- Non-Pulsating Air Flow
- Corrosion-Resistant Construction
- High Capacity—Low Resistance Coils
- Single Equipment Warranty

For complete application service, call your Consulting Engineer or your nearest Sturtevant Division Sales Engineer . . . or write Westinghouse Electric Corporation, Sturtevant Division, Department 14-E, Hyde Park, Boston 36, Mass.

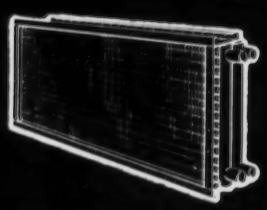
WESTINGHOUSE AIR HANDLING

YOU CAN BE SURE...IF IT'S Westinghouse

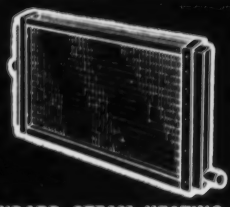
J-80091



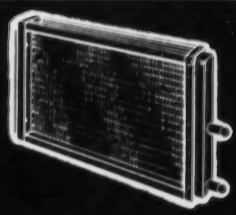
DIRECT EXPANSION FOR COOLING AND DEHUMIDIFYING . . . 3-4-5 and 6 rows deep.



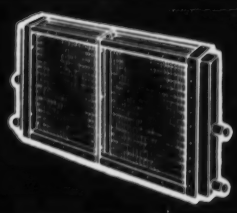
WATER COILS . . . for heating, cooling and dehumidifying—2 through 8 rows deep.



STANDARD STEAM HEATING COILS . . . for use with modulating damper control—1 and 2 rows deep with 3 fin spacings.



STEAM DISTRIBUTING TUBE COILS . . . for use with modulating steam valve control—1 and 2 rows deep with 3 fin spacings.



DUAL FEED STEAM DISTRIBUTING TUBE COILS . . . available in fin tube lengths—78 through 120 in.—1 and 2 rows deep with 3 fin spacings. Operates as two coils in single casing—supply and condensate connections at each end—eliminates stratification.

Random Thoughts from a Filter Engineer

by C. W. Savitz

- **A FEW ELECTRONIC AIR CLEANER "FIRSTS"**
- **STRAIGHT FROM WHICH HORSE'S MOUTH?**
- **THE CASE OF THE OVER-RATED FILTER**
  (Automatic Curtain Division)

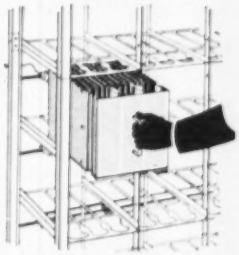
A FEW ELECTRONIC AIR CLEANER "FIRSTS"

In a product as long-established as Electromaze, the fact that its unusual design incorporated many "firsts" ordinarily wouldn't mean too much to the user. In the case of Electromaze, however, most of these features are still exclusive and explain why it is still today's outstanding electronic air cleaner.

Here are some of the features that, to the best of our knowledge, are Electromaze "firsts":

Electromaze has the first diffuser ionizing section and collector plate section built into one unit. Thus each cell is a complete filter that slides into its holding frame like a file drawer. Result, lower cost field assembly and greater ease in inspection and servicing.

Electromaze has the first automatic and semiautomatic washing and oiling unit in movable horizontal headers. Result, water and oil pressure is concentrated in a smaller space. Headers are out of the air stream. Electromaze was first to use dual ionizing wires for double protection against wire breakage. First to have quick bus bar disconnect so that individual cells can be removed instantly without affecting the rest of the system. First to use etched aluminum collector plates for better oil retention, first to have aluminum cells chemically coated for corrosion resistance. First to employ ionizing wire bracket assembly that can be removed by removing a screw.



Electromaze®

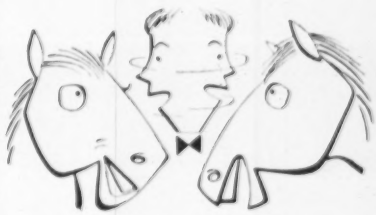
Not as sensational as the invention of the airplane, but to people who buy filters and have to worry about installation and maintenance costs, these "first" developments are rather important.

And these "firsts" promise other engineering "firsts".

STRAIGHT FROM WHICH HORSE'S MOUTH?

Like everybody else in industry, we rely on the technical magazines, journals and so on to keep up to date on what's going on. Who's doing what? Where are the markets for new products? Is anybody making that new product? And how good is it?

And by and large, we admire the job that most magazines do. We have one suggestion, though. We know that some articles originate as publicity releases. Fine. No one is better able to discuss a product and its performance than the manufacturer. But, when a magazine publishes performance data in its editorial pages, the source should be clearly indicated. A phrase such as "according to the manufacturer", tells the reader who is making the claim. They let him know which horse's mouth he's getting his facts from. And, if he chooses, he can make whatever allowance he thinks necessary for parental pride.



We feel it is undesirable for a magazine to jeopardize its prestige among its readers by accepting manufacturers' claims that it has not independently verified. As we said, we rely on magazines. But we hesitate to rely on magazines that pass data on without stating clearly whom they are quoting. After all human judgement is frail enough. Why should anyone want to assume responsibilities for anyone else's frailness?

THE CASE OF THE OVER-RATED FILTER

(Automatic Curtain Division)

Every viscous impingement air filter has an optimum operating velocity under a given set of conditions. Satisfactory performance can also be obtained, within limits, at velocities higher or lower than the optimum.

A good engineering approach to rating the capacity of a filter, especially the automatic viscous curtain-type, is to select the optimum velocity so that the customer will have a margin of safety above or below this figure.

Sometimes, under pressure of competition, filter manufacturers eat into this margin of safety—uprate the filter's capacity either to make the price appear less or to fit into smaller space.

All would be well if the air flow pattern into the filter were equally distributed or if the ventilating air volume were exactly as specified. But all too often, such is not the case. Frequently air distribution is unequal. Many times the designer has been overly conservative in figuring duct losses. This permits more air to flow than the filter was designed to handle. The result is an overall lowering of filter efficiency and possibly oil entrainment.

Our suggestion is that you make sure you have a margin of safety in the capacity of the automatic curtain filters you buy. Some types of automatic filters (and our Automaze is one of them) render excellent performance even when substantially oversized. While this costs a little more, it saves a great deal of trouble in the long run. The Air-Maze Corporation, 25000 Miles Rd., Cleveland 28, Ohio.

AFI MEMBER

AIR-MAZE

The Filter Engineers

AIR FILTERS • SILENCERS • SPARK ARRESTERS
LIQUID FILTERS • OIL SEPARATORS • GREASE FILTERS

Where to buy JENKINS VALVES

and get help in cost reduction from supply specialists

As a Jenkins Valve Distributor, each of the suppliers listed here has proved his ability to select, and provide for his customers, products of exceptional quality and performance. You can rely on this sound judgment when you purchase any of the piping products or other industrial supplies he sells. Make full use of *your* Jenkins Distributor's many services. You will save time, simplify purchasing, and get able cooperation in cost-reduction from supply specialists. Jenkins Bros., 100 Park Ave., New York 17.

ALABAMA

Birmingham	Noland Company, Inc.
Dothan	Alabama Machinery & Supply Co.
Mobile	Mize Supply Co.
Montgomery	Alabama Machinery & Supply Co.
	Noland Company, Inc.
Selma	Selma Foundry & Machine Co.

ARKANSAS

Little Rock	H. O. Nelson Co.

ARIZONA

Phoenix	Western Supply Company
Tucson	Arizona Hardware Co.

CALIFORNIA

Emeryville	Thaler Pipe & Supply Company
Maywood	M. B. Terry Company
Redding	Goettinger Steel & Supply Co.
San Diego	Gould Hardware & Machinery Co.
San Francisco	Atlas Fluid & Company, Inc.
	P. S. Peil & Company, Ltd.

COLORADO

Denver	Hendrie & Bolthoff Company
Pueblo	H. O. Nelson Co.

CONNECTICUT

Bridgeport	Lewis & Sons, Inc.
	The Wellington-Rimmell Co.
Danbury	Warfield S. Mahaney, Inc.
	The Fleming Plumbing Supply Co.
Greenwich	Petty & Company, Inc.
Hartford	The Callahan Company
	Tuttle-Morgan Co., Inc.
	The Plumbing & Mills Corporation
	Thomas Steel & Bro., Inc.
	Ward & Munster
New Britain	New Britain Plumbing Supply Co.
New Haven	The F. S. Merrick & Company
New London	Hunter Supply Co.
Norwalk	Tuttle Supply Co., Inc.
Norwich	The Anderson Supply Company
Putnam	Bentley Plumbing Supply, Inc.
Stamford	Commercial Heating Supply Co.
	Gloster, Inc.
Waterbury	M. J. Daly & Sons, Inc.

DISTRICT OF COLUMBIA

Washington	Thos. Somerville Company

FLORIDA

Fort Lauderdale	Dennis Edward Company
Jacksonville	Kingston-Mathews Co.
	Noland Company, Inc.
Miami	Bailey-Wilson, Inc.
Orlando	Hughes Supply Inc.
Pensacola	Mize Supply Co.
St. Petersburg	Gulf Coast Industrial Supply Co.
Tallahassee	Market Company
Tampa	Noland Company, Inc.

GEORGIA

Albany	Georgia Hardware & Supply Co.
Atlanta	Beck & Gregg Hardware Co.
	Fulton Supply Company
	Grinnell Company, Inc.
	Noland Company, Inc.
	J. M. Tull Metal & Supply Co.
Augusta	Noland Company, Inc.
	Richmond Supply Co.
Brunswick	Market Company
Columbus	Columbus Plumbing, Heating & Mill Supply Co.
	Magnus Corporation
LaGrange	Industrial Supplies, Inc.
Macon	Market Company
	Noland Company, Inc.
	Taylor Iron Works & Supply Co.
Marietta	Noland Company, Inc.
Rome	Battey Machinery Co.
Valdosta	Market Company
	Whitehead Hardware Co.

IDAHO

Boise	Idaho Industrial Supply Co.

ILLINOIS

Bloomington	Wilkins-Bloomington Co.
Chicago	Chicago Tube & Iron Company
	James B. Clow & Sons
	Crane Sales Corporation
	Fred C. Kramer Co.
	Miller Supply Company
Danville	Leland Supply Company
Galesburg	Galesburg Iron & Supply Co.
Peoria	Peoria Pipe & Supply Company
Rock Island	American Rad. & Std. Sanitary Corp.
Rockford	O. & F. Supply Company

INDIANA

Anderson	Main Supply Company
Aurora	Aurora Supply Company
Evansville	Brothers Supply Corporation
Fort Wayne	The National Mill Supply Company
Indianapolis	Plumbers Supply Corporation
Kokomo	The Main Supply Co.
Lafayette	Biggs Pipe & Supply Co.
Marion	Conger Company, Inc.
Richmond	H. & H. Supply Co., Inc.
South Bend	The South Bend Supply Company
Terre Haute	Mechanical Suppliers, Inc.

IOWA

Cedar Rapids	Cedar Rapids Pump & Supply Co.
Des Moines	A. A. Hubbard Mfg. Co.
	Plumb Supply Co.
Dubuque	A. F. McDonald Mfg. Co.
Manchester	Plumb Supply Company
Sioux City	Wigman Company
Waterloo	Waterbottom Supply Co.

KANSAS

Wichita	Phillip & Easton Supply Co.

KENTUCKY

Hopkinsville	Cayce Mill Supply Company
Lexington	Plumbers Supply Company
Louisville	Belknap Hdwe. & Mfg. Co.
	Nevill LaVielle Supply Company
	Plumbers Supply Company

LOUISIANA

Monroe	Morris, Inc.
New Orleans	Edgar Monroe Supply Co.
Shreveport	Monroe Supply Co.

MAINE

Bangor	R. B. Dunning & Co.
Portland	W. L. Blake & Co.

MARYLAND

Annapolis	Thos. Somerville Company
Baltimore	The Taylor Supply Company
Cumberland	The State Mine & Mill Supply Co., Inc.
Hagerstown	Fulte Manufacturing & Supply Co.

MASSACHUSETTS

Attleboro	Bourdon & Lynch Company, Inc.
Boston	Allyne, Ryder & Co., Inc.
	Conley Supply Co., Inc.
	Pierce-Berry Co.
Brockton	Cameron Supply Co. of Brockton, Inc.
Cambridge	Boston Pipe & Fittings Co., Inc.
	Metropolitan Pipe & Supply Co.
	R. C. Sullivan Company
Fall River	Corcoran Supply Co. of Fall River, Inc.
Gardner	Royal Supply Company
Holyoke	The Holyoke Valve & Hydrant Co.
Hyannis	R. B. Corcoran Co. of Hyannis
Lawrence	Bride, Grimes & Co.
Lowell	Middlesex Machine Company
Lynn	The Bourneuf Corporation
New Bedford	Riddell Steam Specialty Co.
Peabody	Boyle Machine & Supply Co.
	Jefferson Industrial Supply, Inc.
Pittsfield	Berkshire Mill Supply Co.
South Boston	Charles D. Sheehy, Inc.
Springfield	Charles Millar & Son Co.
Westfield	Warner Supply Co., Inc.
Worcester	Washburn-Garfield Co.

MICHIGAN

Battle Creek	Randall Hardware Mill & Supply Co.
Benton Harbor	Riddell Supply Co.
Detroit	The Conn-DeVoe Company
Flint	A. P. Engelhart & Co.
Grand Rapids	Hayden Supply Co.
Iron Mountain	Wilhoit Supply Co.
Jackson	The Smith-Winchester Co.
Kalamazoo	Riddell Hardware Mill & Supply Co.
Lansing	The Michigan Supply Co.
Saginaw	E. E. Fuller Co.
	Reliable Supply Co.

MINNESOTA

Duluth	Duluth Plumbing Supplies Company
Minneapolis	Central Supply Co.

MISSISSIPPI

Jackson	Magee Foundry & Machine Co.
	H. O. Nelson Co.
Meridian	Soule Steam Feed Works
Vicksburg	G. Heill McNamara Hardware Co.

MISSOURI

Cape Girardeau	H. O. Nelson Co.
Kansas City	H. O. Nelson Co.
Joplin	Joplin Supply Co.
Kansas City	Mid States Supply Co.
	Reeves-Wiedemann Company
No. Kansas City	Grinnell Company, Inc.
St. Joseph	Missouri Water & Steam Supply Co.
St. Louis	Dorsett Supply Co.
	H. O. Nelson Co.
Springfield	John A. Rhodes Co.

MONTANA

Butte	Montana Hardware Company
	M. & E. Supply Co., Inc.
Missoula	Missoula Mercantile Company

NEBRASKA

Lincoln	Western Supply Company
Omaha	John Paul Rice & Supply Co.
	Midco Supply Co.

NEVADA

Reno	Acme Supply & Equipment Co., Inc.

NEW HAMPSHIRE

Concord	Page Belting Co.
Keene	Parkhill, Manning & Wright, Inc.
Manchester	Colonial Supply Corp.
	Manchester Supply Company
Nashua	W. Webb Company, Inc.

NEW JERSEY

Atlantic City	Seashore Supply Company
Bayonne	Bayonne Plumbing Supply Co.
Bridgeton	Magee Company
Camden	Fleck Company
	Magnus Corporation
	J. D. Johnson Co., Inc.
Elizabeth	Elizabeth Hardware Company
Harrison	William S. Rae, Inc.
	Div. of Charles F. Guyon, Inc.
Irvington	Gerowek & Auerbacher, Inc.
Jersey City	The Ideal Supply Co.
New Brunswick	Baker Rosen Company, Inc.
	Raritan Supply Company
Newark	Geo. J. Keller Co.
	John Simmons Company
Passaic	Central Engrng. & Supply Co., Inc.
	A. & J. Friedman Supply
	Pioneer Pipe & Supply Co., Inc.
Paterson	Federal Supply Co.
	Paterson Supply & Engineering Co.
Perth Amboy	Madsen & Mowell, Inc.
Trenton	Manufacturers Selling Company
Vineland	Endicott Supply Company

NEW YORK

Albany	Singer-Spunk Supply Co., Inc.
Binghamton	Binghamton Industrial Supply Co.
	Chas. Millar & Son Co.
	Ellis W. Morse & Co.
	Sage Supply Co., Inc.
Buffalo	W. A. Case & Son Mfg. Co.
	Spitt & Pfeifer, Inc.
Elmira	Irving D. Smith, Inc.
	LeValley-McLeod, Inc.
Ithaca	Mavercick & Co.
Jamestown	Clark Hardware Co.
Kingston	W. A. Case & Son Mfg. Co.
Long Island City	Corcoran Supply Co., Inc.
	Gear Supply Corp.
	Meyer-Mapes Company, Inc.
Middletown	Orange County Plumbing Supply Co.
Mineola	Bahrer Mason Company, Inc.
Newburgh	W. A. Case & Son Mfg. Co.
	W. L. Smith Co.
New York City	Acco Supply Company, Inc.
	Bahrer Mason Company
	Davis & Warshow, Inc.
	B. F. Grimmel Co., Inc.
	Glauber, Inc.
	Charles F. Guyon, Inc.
	W. H. Hussey & Son, Inc.
	H. B. Kelly Company, Inc.
	McElravy & Mauck Co.
	N. Y. Plumbers' Specialties Co., Inc.
	Herbert Rentz Supply Corporation
	Sutton & Weinstein, Inc.
	Sidney Samuels, Inc.
	Simplex Plumbing Supply Co.
	Smelko Co., Inc.
	The Smith Donegan Company
	Standard Plumbing Supply Co.
	John Wilfert Company
Niagara Falls	W. A. Case & Son Mfg. Company
	The Elderfield Corp.
	Mavercick & Co., Inc.
Ogdensburg	Jagura Plumbing Supply Co., Inc.
Olean	LeValley-McLeod, Inc.
Port Chester	Central Plumbers Supply Co., Inc.
Poughkeepsie	Industrial Plumbing Supply Co., Inc.
	J. D. Johnson Co., Inc.
Rochester	W. A. Case & Son Mfg. Co.
	Mavercick & Co.
	Samuel Sloan & Co.
Syracuse	Burns Bros. Mfg. Co., Inc.
	Edward Joy Co.
Utica	Chas. Millar & Son Company
White Plains	Bahrer Mason Company, Inc.
Woodside	Neill Supply Co., Inc.
Yonkers	Glauber, Inc.
	Joseph C. Ryan & Sons, Inc.

NORTH CAROLINA

Asheville	Magnus Corporation
Charlotte	Grinnell Company, Inc.
	Magnus Corporation
	Textile Mill Supply Co.
	The Henry Walke Company
Durham	Dillon Supply Co.
	Noland Company, Inc.
Fayetteville	Piedmont Supply Co., Inc.
	Standard Supply Co., Inc.
Gastonia	Gastonia Mill Supply Co.
Goldsboro	Dillon Supply Co.
Greensboro	Frank Hackett Supply Co.
	Piping & Equipment Supply Corp.
Hickory	Piedmont Supply Co., Inc.
High Point	Baxter Machinery Co.
Kinston	Noland Company, Inc.
Raleigh	Dillon Supply Co.
	Noland Company, Inc.
Rocky Mount	Dillon Supply Co.
Salisbury	Piedmont Mill Supply Co., Inc.
Shelby	Shelby Supply Co.
Wilmington	Mill & Contractors Supply Co.
Wilson	Noland Company, Inc.
Winston Salem	Baxter Machinery Co.
	Noland Company, Inc.

OHIO

Akron	Mahoning Valley Supply Company
Canton	Mahoning Valley Supply Company
Chillicothe	Grinnell Company, Inc.
Cincinnati	The Murdock Mfg. & Supply Co.
Cleveland	American Rad. & Std. Sanitary Corp.
	Strong, Carlisle & Hammond Co.
Columbus	The Smith Bros. Hardware Company
	Westchester Supply Company
Dayton	The Acme Plumbing Supply Co.
	Dills Supply Company
Lancaster	The Riedel Hardware Co.
Lima	American Rad. & Std. Sanitary Corp.
Logan	American Rad. & Std. Sanitary Corp.
Mansfield	Cook Plumbing & Heating Sup., Inc.
New Haven	New Haven Supply Co.
Sandusky	Roth & Appell Co.
Steubenville	Industrial Supplies Co.
Toledo	The Hardy & Dutzinger Co.
Youngstown	Valley Pipe & Supply Co.
Zanesville	Industrial Supplies Co.

OKLAHOMA

Oklahoma City	Mideke Supply Co.
Tulsa	Arkon Supply Company
	Marshall Supply & Equipment Co.

OREGON

Astoria	Fisher Bros.
Eugene	American Steel & Supply Co.
No. Portland	Moore Dry Kiln Co.
Portland	Morris Supply Company
	J. D. Mosertine & Co.
	Paramount Supply Co.
Salem	Salem Steel & Supply Co.

PENNSYLVANIA

Allentown	Lehigh Valley Supply Co.
Bethlehem	Magnus Corporation
Chester	Magnus Corporation
Easton	H. P. Kinney Company
Erie	Reiser Hardware Supply Company
Franklin	Joney Industrial Supply Co.
Harrisburg	Appleby Bros. & Whittaker Co.
Haverford	Plumbers Supply Co., Inc.
Lancaster	Herr and Company, Inc.
Lansdale	Magnus Corporation
Norristown	United Pipe & Supply Co., Inc.
Philadelphia	Herman Goldner Co., Inc.
	Grinnell Corporation
	Magnus Corporation
	Henry B. Pancoast Company
	C. J. Rainear & Co., Inc.
Pittsburgh	Pittsburgh Gauge & Supply Co.
Pottsville	Reading Foundry & Supply Co.
Reading	Magnus Corporation
	Reading Heater & Supply Company
Scranton	Ralph E. Weeks Co.
Sharon	Pittsburgh Gauge & Supply Co.
Titusville	Pittsburgh Gauge & Supply Co.
Wilkes Barre	Eastern Pennsylvania Supply Co.
Williamsport	E. Keister Company
York	Fulton, Hoering & Mauser Co., Inc.

RHODE ISLAND

Providence	Allen & Reed Company
	Grinnell Company, Inc.
	Rhode Island Supply & Eng'ring Co.
Woonsocket	Woonsocket Supply Company

SOUTH CAROLINA

Anderson	Sullivan Hardware Co.
Charleston	B. L. Montague Co., Inc.
	Noland Company, Inc.
Clinton	Industrial Supply Co.
Columbia	Columbia Supply Co.
	Noland Company, Inc.
Greenville	Poe Hardware & Supply Co.
	Stewart Supply Co.
	Sullivan Hardware Co.
Spartanburg	Mill Supply Company, Inc.
	Noland Company, Inc.
Sumter	B. L. Montague Co., Inc.

TENNESSEE

Bristol	Mitchell Flowers Hardware Co.
Chattanooga	Mills & Lupton Supply Co.
Jackson	Southern Supply Co.
Kingsport	Greene Hardware & Supply Co.
Knoxville	Tennessee Mill & Mine Supply Co.
Memphis	E. C. Blackstone Co.
	H. O. Nelson Co.
Nashville	Buford Brothers, Inc.
	W. A. Case & Son Mfg. Co.
	Noland Company, Inc.

TEXAS

Austin	K & M Supply Company
Dallas	H. O. Nelson Co.
El Paso	Park Hardware Company
Fort Worth	Weil Machinery & Supply
Houston	Corbett Corp.
	H. O. Nelson Co.
Lufkin	Lufkin Supply Co.
	Supply Div. of Lufkin Const. Co.
Marshall	E. B. Hayes Machinery Co.
Paris	Robert L. Swain Co.
San Antonio	San Antonio Pipe & Supply Co.
Texarkana	Buhrman-Pharr Hardware Co.

UTAH

Salt Lake City	H. O. Nelson Co.

VERMONT

Burlington	The Bludgett Supply Co., Inc.
Rutland	Conrey Pipe, Inc.
St. Johnsbury	Charles Millar & Son Co.

VIRGINIA

Charlottesville	Noland Company, Inc.
Danville	Magnus Corporation
Lynchburg	Baker Jennings Corp.
Newport News	Noland Company, Inc.
Norfolk	Magnus Corporation
	The Henry Walke Company
Richmond	Magnus Corporation
	Industrial Supply Corporation
	Noland Company, Inc.
	Southern Industrial Supply Co.
Roanoke	Graves Humphreys Hardware Co., Inc.
	Noland Company, Inc.
Waynesboro	Meek Supply Company

WASHINGTON

Seattle	Northern Commercial Co.
	Stearns Rubber Co.
Spokane	North-west States Supply Co.
	Sullivan Valve & Engineering Co.
Tacoma	Paramount Supply Co.
Walla Walla	Grumbeller Co.

WEST VIRGINIA

Charleston	McJunkin Corporation
Clarksburg	Osburn Machinery Co., Inc.
Huntington	Logan Hardware & Supply Company
Logan	Logan Hardware & Supply Company
Weston	Dunbar Hardware & Supply Co.
Wheeling	Trimble & Lutz Supply Co.

WISCONSIN

Appleton	W. S. Patterson Co.
Green Bay	Murphy Supply Co.
Kenosha	E. M. & L. Supply Co.
La Crosse	W. A. Roosevelt Co.
Madison	Automatic Temperature Supplies, Inc.
	Bundle Specialty Mfg. Co.
Manitowoc	William Rathsack & Sons Co.
Milwaukee	B. F. Grimmel Co.
	E. Hoffmann Mfg. Co., Div. Grinnell Company, Inc.
	Bundle Specialty Mfg. Co.
Nekoosa	Nekoosa Edwards Paper Co.
Oshkosh	Battle Bros.
Racine	Thomas Supply Co.
Sheboygan	Sheboygan Iron Works
Watertown	Russel Geary Equipment Co.

Industry's top-rated Suppliers sell . . .

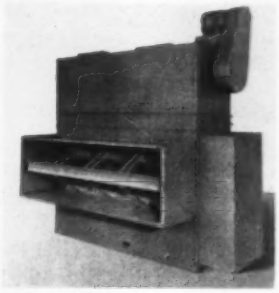
JENKINS VALVES

BRONZE • IRON • CAST STEEL • STAINLESS STEEL

Jenkins Bros.

EQUIPMENT DEVELOPMENTS

For reviews of Recent Trade Literature see Page 258



Air Conditioner . . .

. . . in 20 ton, floor type, commercial packaged model added to company's line. *American Blower Corp., Dept. HPAC, Detroit 32.*

Designed for use with fully ducted installations. Recommended by company for installation in restaurants, churches, small theaters, offices, banks, small stores, small factories, etc. Packaged line now includes 3, 4, 7½, 10, 15, 20 ton sizes.

Insert Rings . . .

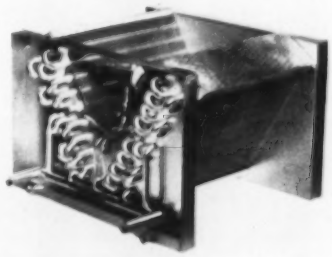
. . . designed for inert gas tungsten arc welding of piping without backing rings, smoother root pass welds with elimination of root pass cracking, improved weld contours in thin wall piping with fewer passes. *Industrial Piping Div., Grinnell Co., Inc., Dept. HPAC, Providence, R. I.*

For standard, special pipe and tube sizes 1½ in. or larger. Shown is positioning of ring with positioner pins in pipe joint eccentric to center line of pipe.

Pipe Insulation . . .

. . . designed to insulate, protect underground piping from corrosion. *G. S. Ziegler & Co., Dept. HPAC, 99 Church St., New York 7.*

"Insul-ite" is blend of natural hydrocarbon, which, when steam is introduced, fuses itself to pipe, forms thick protective coating that requires no maintenance, replacement, repair, says company. Applied by filling in area around pipes, rather than by wrapping.



Dual Cooling Coil . . .

. . . assembly for plenum installation. *Tubeaire Coil Co., Dept. HPAC, 3037 Hartford St., Houston.*

"V" type coil available in 2, 3, 5 ton capacities for use with remote air cooled condensing units. Each coil fed by two liquid distributor lines from expansion valve. Equalizer line balances liquid valve to maintain active coil sections. Suction line header has two connections with each coil said to provide easy access for low pressure vapors to suction line.

Constrictor, Cutter . . .

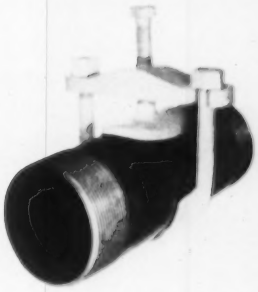
. . . combination for tubing. *Imperial Brass Mfg. Co., Dept. HPAC, 1200 W. Harrison St., Chicago 7.*

For cutting tubing or for constricting larger tube to outside diameter of smaller one preparatory to making solder connection. Used with standing cutting wheel for cutting. Second wheel, with rounded contour, used in place of cutting wheel for constricting.

Ball Bearing Units . . .

. . . rubber cushioned for quiet operation. *Fafnir Bearing Co., Dept. HPAC, New Britain, Conn.*

Designed for commercial heating, air conditioning equipment. Cited features: extended inner ring for greater shaft support; self locking collar for easy assembly; removable "Flva-Seals," said to keep lubricant in, contaminants out; prelubrication. Line includes pillow block units, rubber cylindrical cartridges.



Pipe Leak Repair Tool . . .

. . . designed to repair leaks quickly, permanently, economically. *Atlas Industries, Inc., Dept. HPAC, P. O. Box 3152, Houston.*

Consists of pipe clamp, patches, which are shaped to fit specific pipe sizes. Tool made in two styles: saddle type in four sizes for use on pipe to 6 in. diameter; chain type in all sizes greater than 6 in. Patches are steel with neoprene or asbestos gaskets.

Cutoff Machine . . .

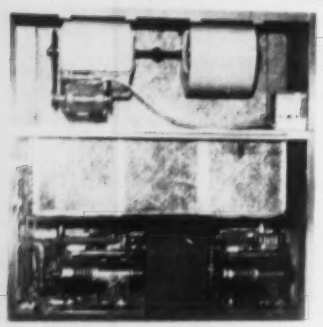
. . . with work head, belt guard assembly offered as separate package for use in building special purpose

EQUIPMENT DEVELOPMENTS

Continued

machines—*Delta Power Tool Div., Rockwell Mfg. Co., Dept. HPAC, 449 N. Lexington Ave., Pittsburgh 8.*

Can cut nonferrous tubing to 2 in. OD, nonferrous solids to 1 1/2 in. thick, says company. Using abrasive wheel, is designed to cut 1 1/4 in. ferrous tubing with 5/32 in. wall, ferrous solid stock to 3/4 in. diameter.



Air Conditioners . . .

. . . in 10, 15 ton selfcontained models—*Union Asbestos & Rubber Co., Heating and Cooling Div., Dept. HPAC, 332 S. Michigan Ave., Chicago.*

Designed for commercial, industrial, institutional use. Cited feature is pump-down control system engineered to insure that minimum of gas remains at low pressure in coils when machine shuts down. Equipped with dual cooling coil circuits, controlled with separate thermostatic expansion valves. Each unit has two accessible hermetic compressors, dual condenser circuits.

Valve . . .

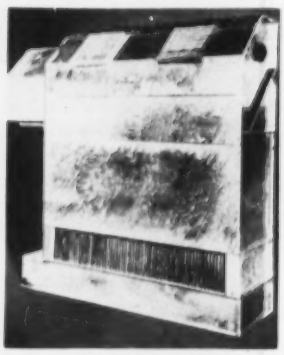
. . . for pressure reducing, regulating service for liquids, steam, gases—*A. W. Cash Co., Dept. HPAC, P. O. Box 551, Decatur, Ill.*

Cited improvements include 50 percent reduction in number of flange bolts to save maintenance time, introduction of gasket seal at diaphragm flange for easier pressure range conversion. Available in iron, bronze, steel or stainless steel body, and bronze, stainless steel, alloy trim. Screwed ends are 1/2 to 2 in.

Arc Welding Machines . . .

. . . in three new models—*Air Reduction Sales Co., Div. of Air Reduction Co., Inc., Dept. HPAC, 60 E. 42nd St., New York 17.*

Models are: d-c rectifiers; a-c/d-c rectifier for metallic arc welding; a-c/d-c "Heliwelder" for inert gas, metallic arc welding.



Evaporative Condensers . .

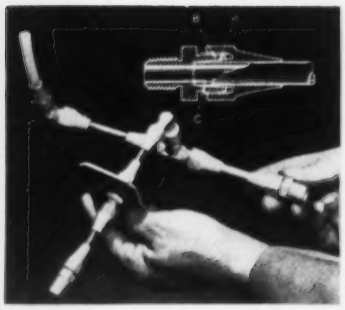
. . . in capacities 20 to 150 tons at 75 F wb—*Acme Industries, Inc., Dept. HPAC, Jackson, Mich.*

"Flow-Mizer" has blower section with air outlets on 45 deg angle for any direction of air discharge, says company. External pump is said to simplify water treatment, servicing of sediment screen, draining of unit. Drift eliminators, nozzles, condenser tubes designed for easy accessibility.

Convector . . .

. . . engineered for installation, maintenance ease—*Trane Co., Dept. HPAC, La Crosse, Wis.*

Cited features of "Type C" unit: snap-on front panel; single piece, rolled top and sides; new method of element suspension.



Plastic Fittings . . .

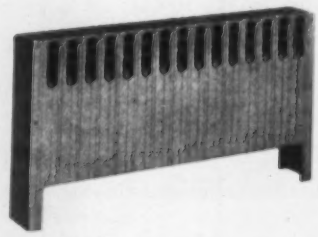
. . . for use with metal or plastic tubing—*Jaco Mfg. Co., Dept. HPAC, Box 2659, Cleveland 7.*

Molded from "Zytel" (Du Pont) polyamide resin, are said to offer advantages of lighter weight, increased resistance to attack by most acids and alkalis. In complete line of shapes, sizes 1/8 to 1/2 in. tube and pipe sizes. Temperature range in —70 to 295 F. Cited feature is that nut has molded integral ferrule engineered to provide flareless vibration, leakproof seal to 500 psi.

Air Conditioners . . .

. . . in new models added to company's 1956 line—*Frigidaire Div., General Motors Corp., Dept. HPAC, Dayton 1.*

Featured in new window type units are 1 1/2 hp unit, 1 hp reverse cycle (heat pump) model. Cited features of new window unit line are fast pull-down, increased capacity, high power factor. Line offered in two series of models, "Deluxe" and "Super."



Radiation . . .

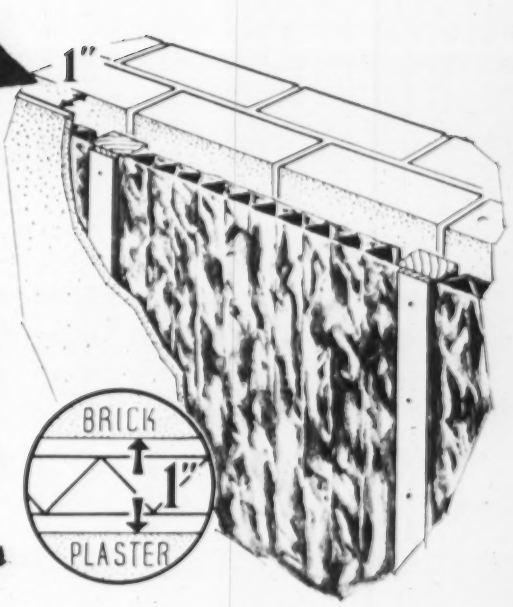
. . . in free standing and recessed radiant and convection types—*Dunkirk Radiator Corp., Dept. HPAC, Dunkirk, N.Y.*

Unit designed for attractive appearance, ruggedness, high heat

HOW TO

Insulate Masonry Walls Get 2" Insulation Value Create 1" Wall Space

PROTECT WALLS OF BRICK, STONE, CONCRETE AND CINDER BLOCK AGAINST HEAT LOSS, HEAT INTRUSION, AND DAMPNESS AT ABOUT 8¢ SQ. FT. (Insulation and Labor)



Insulate economically and effectively against heat and vapor flow in masonry construction, with 2 sheets of tough aluminum separated ½" apart by a flame, mold, and insect retardant accordion fiber. They install easily in one operation to furring strips. Only ½" deep installed, this insulation fits into the shallow 1" spaces created by the furring.

Comfortable areas can also be created in basements and other places in existing buildings for playrooms, storage, laundries, workshops, even living quarters; by this scientific construction of multiple aluminum and reflective spaces.

A MUST FOR SHALLOW SPACES

Cellar Walls	Air Ducts	Cold storage bins
Floor panels	Floors	Heated trucks
Airplanes	Ships	Prefab buildings
R.R. trains	Trailers	Freight cars
	Refrigerated trucks	

HEAT AND VAPOR FLOW RETARDED

With respect to radiant heat flow, the aluminum surfaces of this insulation have 97% reflectivity, and only 3% absorptivity and emissivity. Conduction is slight through the air spaces of low density. The layers of aluminum and fiber retard inner and outer convection. These comprise ALL methods of heat flow.

Because they are METALLIC and CONTINUOUS, the aluminum sheets are almost impervious to vapor flow. Infiltration under the flat flanges is slight. The possibility of condensation formation on or within this kind of insulation is minimized by the scientific construction of multiple layers of aluminum, fiber and air spaces.

This scientific insulation is commercially available as Infra Type 4 Jr. It has 4 reflective spaces, 2 outer, and 2 inner rows; and 4 reflective surfaces. Made for 16" centers, it is packed 500 sq. ft. to a carton in one continuous strip. It is also available with an asbestos partition.

HOW TO INSTALL

Attach 1" furring strips to walls on 16" centers. Tack flange of unopened Type 4 Jr. to *face* of furring strip with an occasional staple, bottom (flat) surface facing room. Expand insulation and tack to face of adjacent furring strip. Lap and tack flange of next piece of insulation *over* previously tacked flange of adjacent installed insulation. Nail rough lattice strip *over* combined flanges, which will prevent contact with subsequently installed lath or wall board, and create an additional air space.

The U.S. NATIONAL BUREAU OF STANDARDS has published an informative booklet describing the destruction which condensation can cause and means of preventing it. It is entitled "Moisture Condensation in Building Walls." Send us coupon for a FREE copy.

Get a FREE SAMPLE of this unusual insulation. Check the box in the coupon.

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525 Bway., New York, N. Y., Dept. H-5

Please send ☐ sample of Type 4 Jr.
☐ "Moisture Condensation in Building Walls."

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Firm_____

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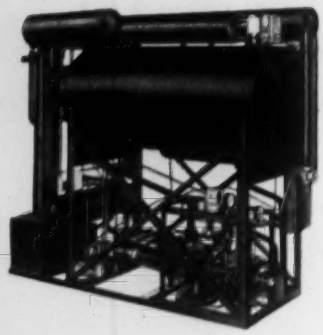
EQUIPMENT DEVELOPMENTS

Continued

transfer efficiency, easy installation. Integral fins direct heat outward into room through grille openings. In lengths 9 to 99 in. in 4½ in. increments and in a 20 in. height. No covers required.



Packaged Chiller . . .

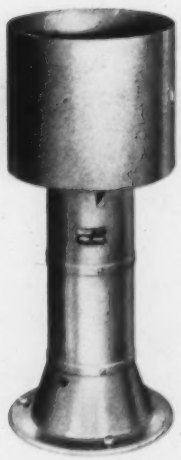
. . . designed with its own factory assembled operating, safety controls—*Servel, Inc., Dept. HPAC, Evansville 20, Ind.*

Three connections to water, steam, electricity—put unit into operation, says company. Capacity is 25 tons. May be reduced to as low as 50 percent of rating with corresponding reduction in steam consumption. Recommended by manufacturer for temperature and humidity control in textile mills, sugar refineries, printing plants; process cooling in canning, bottling plants; removing heat of chemical reactions in anodizing, electroplating operations, air conditioning in offices, motels, apartments, hospitals.

Flow Meter . . .

. . . for measurement, control of mass rate of flow of liquids—*Industrial Development Laboratories, Inc., Dept. HPAC, 17 Pollock Ave., Jersey City.*

Electro-caloric unit uses rate of heat transfer through boundary layer of liquid to obtain measurement of flow. Suited for corrosive fluids, gases, slurries, hydrocarbons, biologies, beverages, etc., says company. Linear scale designed to cover wide flow range including pulsating ones.



Heating, Cooling System . .

. . . for schools, public buildings—*C. A. Dunham Co., Dept. HPAC, 400 W. Madison St., Chicago 6.*

"Vari-Air" system engineered for simplicity, flexibility, said to reduce initial costs, require less maintenance, save space. In aspirating, power fan types with capacities ranging 500 to 1700 cfm per unit.

Abrasive Cutting . . .

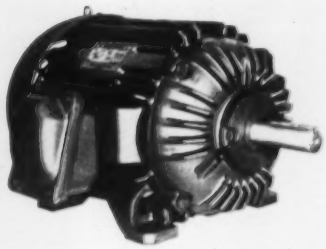
. . . machines in two new models added to company's line—*Beaver Pipe Tools, Inc., Dept. HPAC, Warren, Ohio.*

"Any-Angle" unit uses standard cutting head mounted on special base with pivot built into base. Vise, material remain stationary. Cutting head swivels to permit any angle cut 30 to 90 deg. "Wet-Cutting" machine has circulating cooling pump (with separate motor, control) said to produce polished cut with no burr. Unit equipped with magnetic switch, air vise.

Air Valve . . .

. . . designed for use as directional, interlocking, transfer, sequence, or shutoff valve—*Industrial Products Div., Westinghouse Air Brake Co., Dept. HPAC, 3 Gateway Center, Pittsburgh.*

For service in pneumatic control systems with pressures to 250 psi, temperatures to 200 F. New ¼ in. size supplements ½ in. size. Cited features: damage resistant seal, corrosion resistance, increased capacity, compactness, higher operating pressure, stable mounting, low maintenance.



Synchronous Motor . . .

. . . for metering, proportioning pumps—*Allis-Chalmers Mfg. Co., Dept. HPAC, 1171 S. 70th St., Milwaukee 1, Wis.*

"Synduction" line available in ratings ¼ to 40 hp. Motor requires no brushes, slip rings, windings on rotor or separate source of direct current excitation, or special starting equipment, says company. Units available over wide frequency, speed ranges.

Cooling Towers . . .

. . . in capacities 15 to 100 tons—*Acme Industries, Inc., Dept. HPAC, Jackson, Mich.*

Cited features of "Flow-Mizer" line are: stepped-up capacities, increased efficiency through incorporation of "Acme-Pak" (which consists of series of vertically mounted steel plates said to create ideal conditions for evaporation, fast heat dissipation). Centrifugal blowers provide air flow with ample capacity for use with ductwork, when needed, says company.

(Continued on page 206)

BIFURCATOR® FAN

key to your corrosive fume removal problems

BIFURCATOR is the divided-housing fan backed by 30 years experience in design and application.

Ideal for corrosive, high temperature and hazardous fume removal from:

- CERAMIC KILNS
- CERAMIC PLANT INSTALLATIONS
- CHEMICAL PLANT INSTALLATIONS
- CHEMICAL LABORATORY HOODS
- CORE BAKING OVENS
- DRYING OVENS
- DYE HOUSES
- ELECTROPLATING TANKS
- FOOD PROCESSING OVENS
- FOUNDRIES — POURING AREAS
- FOUNDRIES — SHAKE-OUT AREAS
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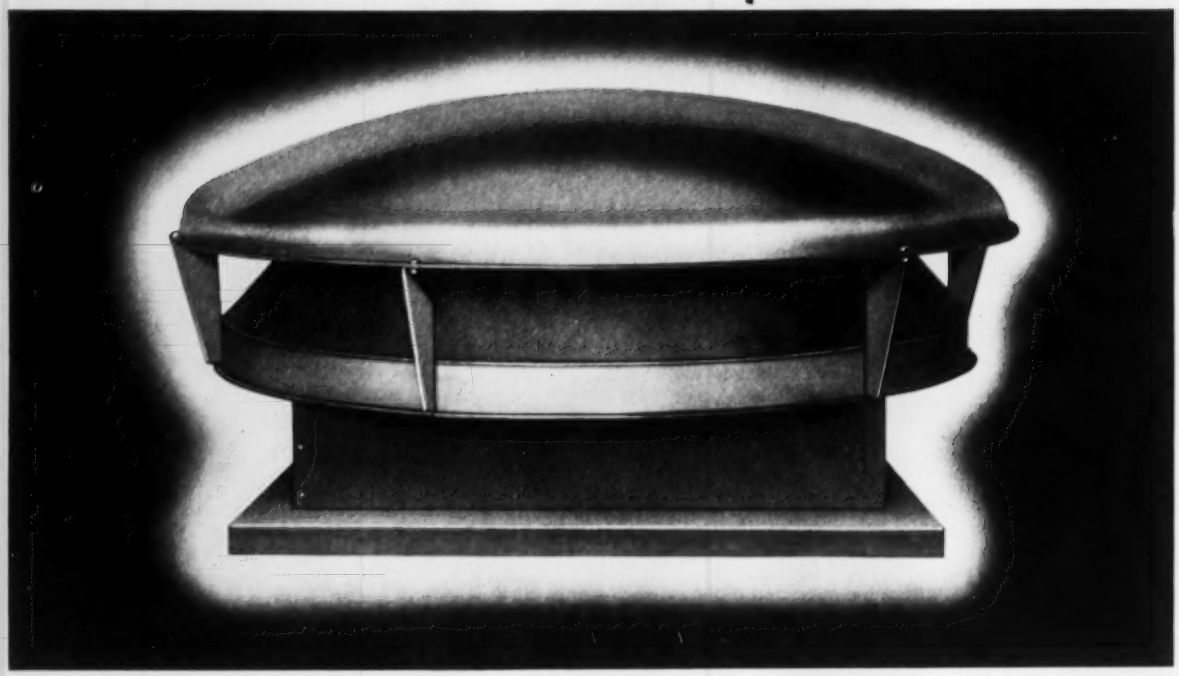

NEW *Allen* "I-LINE" ROOF FAN
Gives You the *LOW CONTOUR* You Want

. . . and with the

FEATURES YOU WANT

- Low silhouette
- Low noise level
- High efficiency
- Rigid construction
- Low first cost
- Low operating cost
- Vibration-free for long life
- Easy to install (no extra base needed)
- Easy accessibility for lubrication, inspection and cleaning
- Versatility (supply or exhaust units)
- Wide capacity range (400 to 34,000 cfm)
- Choice of two types of standard base

The new *Allen* "I-Line" Roof Fan meets the architect's demand for an attractive unit that hugs the roof without sacrificing the high efficiency required by engineers. This is accomplished by a circular spun hood and fan venturi with a directional baffle so arranged in relation to the propeller as to provide maximum efficiency with minimum over-all height.

In addition, the new "I-Line" design makes installation exceptionally easy and the hinged hood simplifies maintenance and cleaning.

The *Allen* "I-Line" Series Roof Fans are available with *Direct Drive* (400 to 34,000 cfm) or with *Belt Drive* (4,000 to 20,150 cfm).

•

See Sweet's (8b/Al) or write for catalog that gives you specifications and complete performance data.

ALLEN ENGINEERED VENTILATION

ALLEN COOLER & VENTILATOR, INC.

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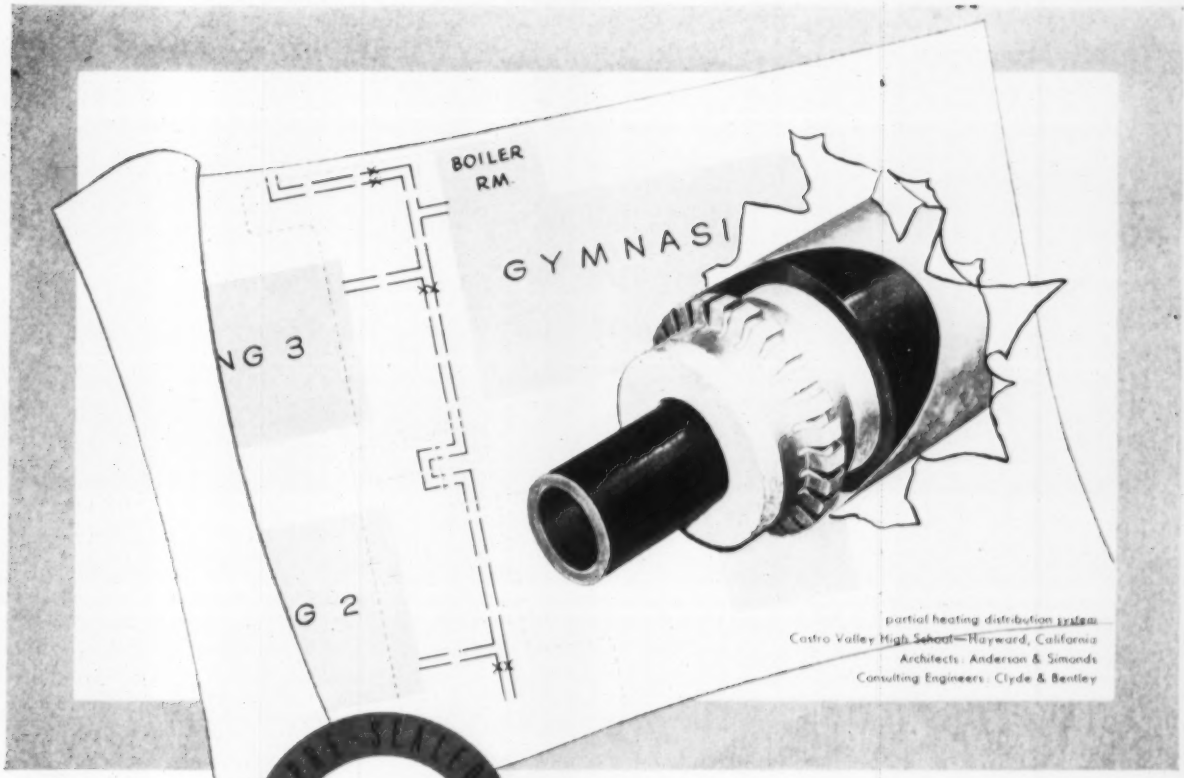
Roof ventilators for every commercial and industrial need • Representatives in principal cities



partial heating distribution system
Castro Valley High School—Hayward, California
Architects: Anderson & Simonds
Consulting Engineers: Clyde & Bentley

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LOW INSTALLATION COST TODAY

LESS MAINTENANCE COST TOMORROW

Expanding school populations across the nation focus increasing attention on costs and on Durant factory-prefabricated insulated pipe systems.

ORIGINAL COST is low with D. I. P. The packaged increments of conduit and standard fittings are rapidly field-joined, with only the pipe itself requiring a weld. No concrete tunnels, masonry, special underground supports, or sub-drains are needed.

CONTINUED COST is less with D.I.P. Its integral layer of non-porous asphalt completely waterproofs the insulation, and prevents corrosive elements from reaching the pipe. Even complete submersion is harmless! Maintenance-creating manholes, expansion joints and other devices can be eliminated by use of standard D.I.P. expansion fittings.

54-PAGE D.I.P. CATALOG #35 GIVES COMPLETE DETAILS, WRITE FOR IT

STAFF ENGINEERS AND REPRESENTATIVES IN PRINCIPAL CITIES AND IN CANADA ARE AT YOUR SERVICE

Western Manufacturing Division
DURANT INSULATED PIPE COMPANY
PALO ALTO • CALIFORNIA

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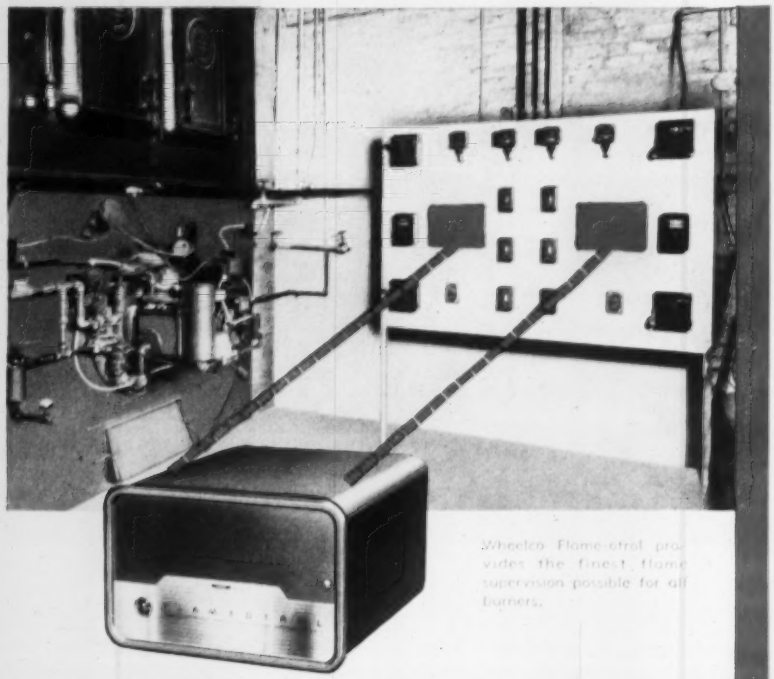
THE MARK OF QUALITY

BARBER COLMAN

Wheelco Instruments

Here's Positive Protection Against Flame Failure— Specify Flame-otrol for Any Type Burner!



Wheelco Flame-otrol provides the finest flame supervision possible for all burners.

Wheelco Flame-otrol combustion safeguard systems offer unfailing, positive protection for any burner—gas, oil, or combination gas-oil.

One basic type, the Series 1470 Conductivity-Rectification system, uses the ability of a flame to conduct current to protect manually or semi-automatically ignited gas, oil, or combination fuel burners.

Series 1570 Infrared System, the other basic type, depends on the fluctuating current of a flame frequency for relay response. All Wheelco Flame-otrols offer the advantages of compact plug-in design, standard electronic tubes, heavy-duty construction, and other advanced features.

Your Wheelco field engineer can help you select the right flame supervision system, choosing from a full line of instruments and accessories. Call him today.

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BARBER-COLMAN OF CANADA, LTD., Dept. E, Toronto and Montreal, Canada

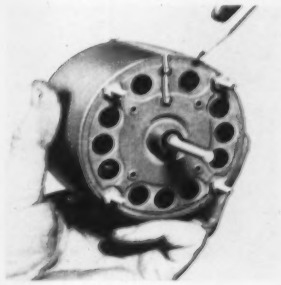
EQUIPMENT DEVELOPMENTS

(Continued from page 202)

Air Conditioners . . .

. . . engineered for flexibility, economy of installation—*Carrier Corp., Dept. HPAC, Syracuse 1.*

Using remote sources of refrigeration and heat and permitting individual zone control of temperature year 'round, plus dehumidification, air circulation, filtering, ventilation, units are suitable for motels, hotels, apartment houses, hospitals, office buildings, says company. "Room Weathermaker" and "Unit Weathermaker" units available in cooling capacities ½ to 1 ½ tons, air handling capacities 200 to 600 cfm.



FHp Electric Motor . . .

. . . designed for compactness, to be light in weight—*Redmond Co., Inc., Dept. HPAC, Owosso, Mich.*

Has wide variety of applications in heating, ventilating, air conditioning field, says company. Type "AL-1" unit has four-pole design; operates at 1550 rpm, 115 or 230 volts, 60 cycles. Develops 1/250 to 1/15 hp.

Right Angle Gear Drives . .

. . . in increased size range 11 to 150 hp—*U.S. Electrical Motors, Inc.,*

"WITCH"

PIPE HANGERS

FOR

HEATING – PLUMBING
POWER & PROCESS

WITCH STANDARD AND SPECIALLY FABRICATED PIPE HANGERS AND SUPPORTS ARE SERVING COMMERCIAL INDUSTRIAL AND INSTITUTIONAL AND PUBLIC BUILDINGS COAST TO COAST

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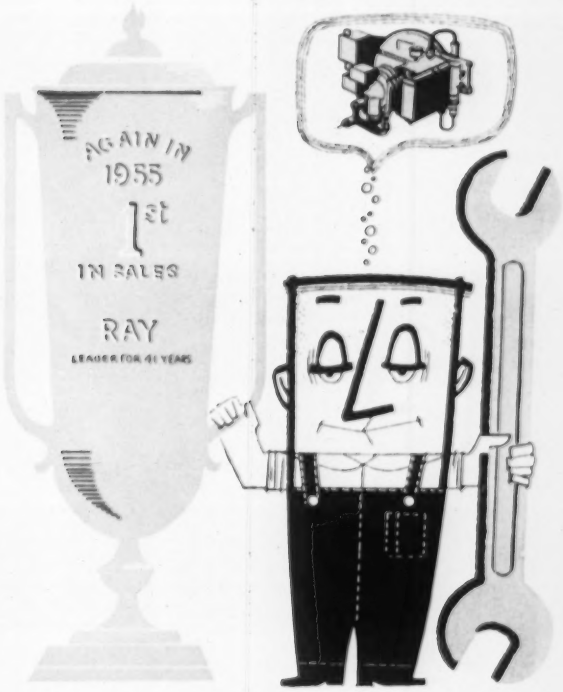
18 HURLEY ST., CAMBRIDGE, MASS.

Only RAY gives you both!



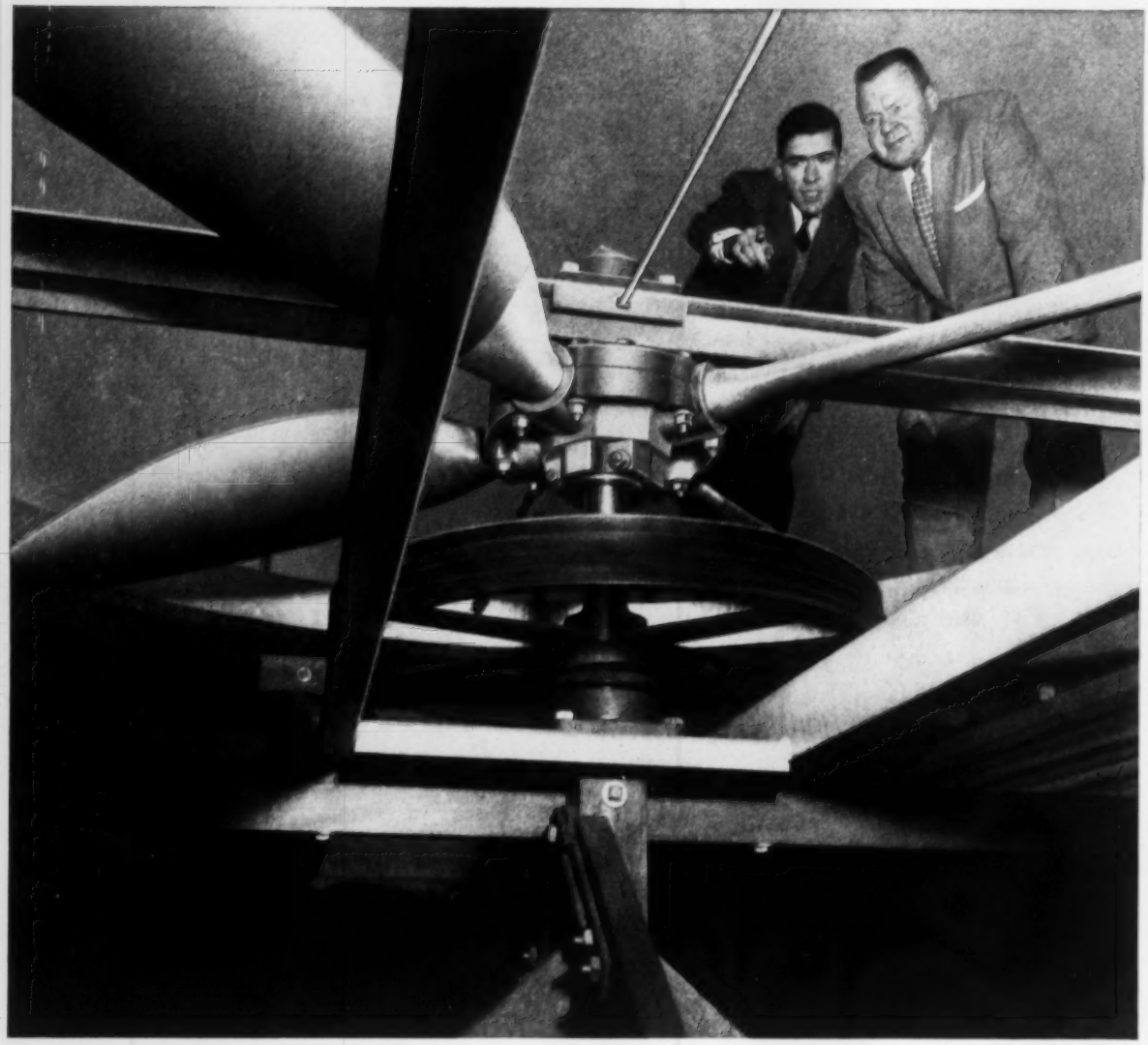
A quality burner
plus
local service

Again in 1955, as for the past 41 years, Ray was the leader in rotary burner sales. This leadership is positive proof that Ray rotary oil, gas or combination gas-oil burners are the first choice of the heating industry.

When you know Ray products and have experienced Ray service, you will then see why Ray continues to be the leader. On-the-spot local burner service eliminates costly shutdowns. Your local, factory-trained Ray dealer knows his product, knows how to service it quickly and economically. Further, he is backed by Ray factory engineers on any complex problems.

Your local Ray dealer will be glad to discuss details of your present or planned installation. Ray dealers are listed in the yellow pages of your telephone directory under Oil Burners — or, write us for the name of your Ray dealer.

RAY OIL BURNER COMPANY
1301 San Jose Ave., San Francisco 12, California
629 Grove Street, Jersey City, New Jersey



"Take a look at the fan assembly on this LoLine Tower, Charlie."

"Looks rugged, doesn't it?"

"And it is. Yet the design is simple. About all there is to it is that heavy-duty fan wheel; those over-size bearings, the multi-V belt drive and that galvanized fan stack."

"Where's the motor?"

"Outside of the hot, moist air stream. No corrosion that way. Pritchard doesn't give rust a chance on the LoLine. Notice that the structural members supporting the fan assembly are hot-dip galvanized."

"But how about the fan shaft? Is it protected, too?"

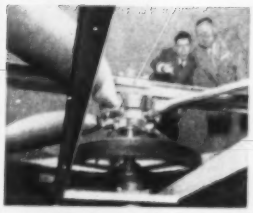
"Stainless steel! And it has self-aligning bearings. See how those snap rings are used for positioning bearings! Speaking of the bearings — you grease these bearings from *outside* of the tower."

"Outside!"

"Yes, see those copper tubes? They run from the grease fittings outside to the bearings. Makes lubrication much easier and a lot safer. Pritchard also makes available a speed reducer drive, if desired."

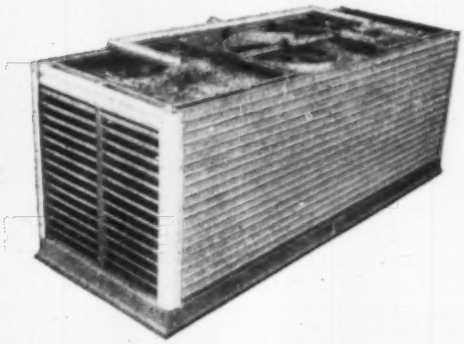
"No wonder you were so excited about this LoLine tower. Pritchard sure did go out of their way to make it a good one didn't they?"

J. F. PRITCHARD & CO. OF CALIFORNIA
4625 Roanoke Parkway, Kansas City 12, Mo.



"Take a look at the fan assembly on this LoLine tower, Charlie."

Pritchard LoLine® Is Lowest Silhouette Tower of 75 Tons Capacity and Up!



The Pritchard LoLine Cooling Tower is the lowest (7' 7 11/16" over-all) tower of 75 tons capacity and up now available. The LoLine incorporates many features in its design which are unique in low silhouette tower construction:

1. Galvanized steel fan drive supports and basin accessories.
2. Grease fittings for bearings on V-belt drive are outside tower.
3. Corrugated asbestos cement board casing.
4. Asbestos cement board louvers are standard, not special equipment.
5. Internal pipe supply system. Piping is completely concealed. (Optional.)
6. V-belt drive has stainless steel fan shaft.

GET ALL THE FACTS!

Write today on your company letterhead for your copy of the LoLine Bulletin 5.1.902. It gives complete details on this new, low silhouette tower. No cost or obligation, of course.

INDUSTRY'S PARTNER FOR PROGRESS

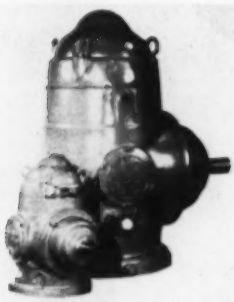
J.F. Pritchard & Co.
OF CALIFORNIA
A DIVISION OF J. F. PRITCHARD & CO.

Dept. 473, 4625 Roanoke Parkway
Kansas City 12, Mo.

COOLING TOWERS • GAS & AIR TREATING EQUIPMENT
REPRESENTATIVES IN PRINCIPAL CITIES FROM COAST TO COAST

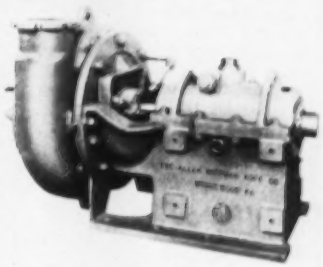
EQUIPMENT DEVELOPMENTS

Continued



Dept. HPAC, Box 2053, Terminal Annex, Los Angeles 54.

Are said to be available in wide selection of gear ratios, speeds. Designed to be adaptable to any vertical turbine pump. Driven by gas, gasoline, or diesel engine. "Holloshaft" gear drive engineered to permit pump shaft to be mounted integrally, to facilitate high efficiency, adjustment of pump impellers.



Centrifugal Pumps . . .

. . . designed for transporting mixtures of abrasive materials—*Allen-Sherman-Hoff Co., Dept. HPAC, 259 E. Lancaster Ave., Wynnewood, Pa.*

"Hydroseal" principle employs small stream of clear water which flows continuously through clearance spaces between rotating impeller and stationary parts into shell and suction eye of impeller.

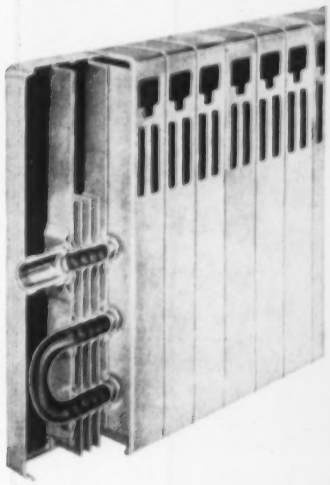
Bearing Assembly . . .

. . . adaptable to vertical, horizontal mounting—*Randall Graphite Bearings, Inc., Dept. HPAC, Greenlawn Ave., Lima, Ohio.*

Combines two sleeve bearing ball assemblies in single steel housing. For vertical mounting or thrust ap-

SHAW PANEL RADIATORS

designed for proper distribution of boiler heat in each room



Only Shaw Radiators are designed and constructed for proper room heat distribution. Their exclusive AIR-e-ATED Radiant Heat is a health-guarding, engineered combination of convected and radiant heat that only Nature — at her best — can duplicate.

Shaw Panel and Baseboard Radiators are self-contained, one-piece-bonded units just 3" thick — easy to handle and install. Choice of tapping permits simplified piping, lower piping costs. Hot water or steam may be used up to 150 psi.

Write today for full information. And be sure to ask for your free copy of Shaw's new illustrated book, "Solving Modern Room Heat Distribution Problems."

SP-8

MANUFACTURED BY
SHAW-PERKINS
201 EAST CARSON ST. • PITTSBURGH 19, PA.

DOUBLE BOILER BLOW-OFF SAFETY

1

Quick-Operating EVERLASTING Straight-Through Valve

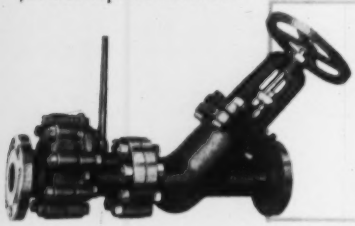
The standard Everlasting design which opens with a quarter-turn of the lever and closes with a drop-tight seal that actually improves with use.

2

Shock-Resisting EVERLASTING Angle Valve

Specially designed and stoutly constructed to withstand severe service and the shocks and abrasion of blow-down solids.

Conform with ASME codes. Available in a range of sizes for pressures up to 600 psig. *Write for descriptive bulletin.*



EVERLASTING DUPLEX UNITS

also available with Y Valves and in any combination of Quick-Operating, Angle and Y Valves.

For "everlasting" service, use

EVERLASTING *Valves*

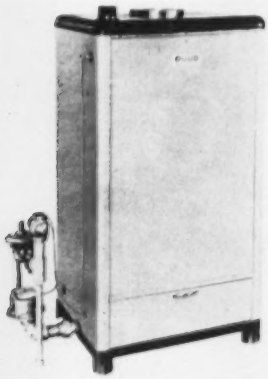
EVERLASTING VALVE CO.
61 FISK STREET, JERSEY CITY 5, N. J.

EV 393

EQUIPMENT DEVELOPMENTS

Continued

plications. "Duplex" is composed of graphited flanged bearing with special design thrust collar and regular graphited ball assembly. In ¾, 1 in. shaft sizes. For horizontal mounting, unit incorporates any of variations of company's "Deep-Well" ball assembly. Shaft sizes are ½ to 1 in.



Gas Water Heater . . .

. . . designed for use with auxiliary storage tank in commercial, industrial water heating applications—*Ruud Mfg. Co., Dept. HPAC, Kalamazoo, Mich.*

For natural, mixed or manufactured gas. When installed, singly or in multiples, with auxiliary horizontal or vertical storage tanks of 100 to 3000 gph capacity. "Model 500A" is said to provide efficient water service for apartment houses, hotels, larger motels, industrial plants, etc.

Air Conditioners . . .

. . . in six selfcontained models for commercial applications—*Mitchell Mfg. Co., Div. of Cory Corp., Dept.*

Get the most from your pump investment

TYPE CVS—duplex unit
TWO FLOAT SWITCHES

Recommended for heavy duty service. Separate control mechanism for each pump motor—or one float which controls automatic alternator.

Write for *Bulletin No. 21-B*

There's a wide range of types and capacities for every heating pump need. Let Skidmore advise you on your next tough job.

TYPE UV

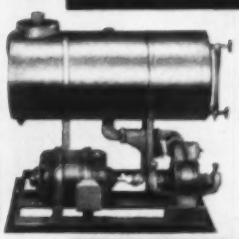
Type UV Condensation Pump is designed for below floor level returns, and is built in single and duplex units.

Write for *Bulletin No. 19-A*

TYPE HS

Type HS Pump is recognized for its dependable low operating cost. Capacities range from 1,000 to 65,000 sq. ft. EDR and pressures from 10 to 75 pounds.

Write for *Bulletin No. 14-A*



TYPE TM

Type TM High Pressure Turbine Pump. Designed for pressures up to 150 pounds and boilers to 250 H.P.

Write for *Bulletin No. 17*

THE SKIDMORE CVS SETS THE PACE IN PUMP PERFORMANCE!

Send for the NEW Bulletin

The CVS vertical pump offers more for your money—mechanical shaft seal—greater range of discharge pressures—still retains compact design and light weight.

TYPE CVS—SINGLE UNIT

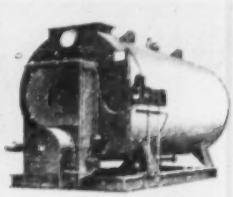
Representatives in principal cities.

Skidmore Pumps have set a Standard of performance and dependability since 1921.

SKIDMORE PUMPS

SKIDMORE CORPORATION
ST. JOSEPH, MICHIGAN

Wherever Continental Automatic Boilers are installed, people are saving money.

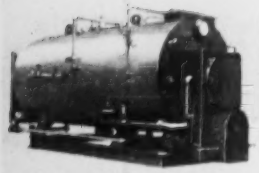


Front and right side view of one of four 400 hp Continental Automatic Boilers ready for shipment to four cement products processing plants.

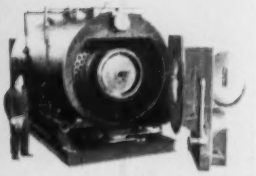
With a

Continental BOILER

You, too, can...

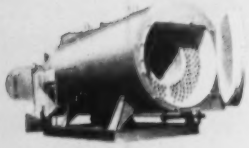


Front and left side view of same 400 hp unit — note simplicity of design.



View with front doors open showing gas burner assembly.

View with rear door open—showing furnace, return tubes and refractory-lined rear door.



SAVE ON INITIAL COST!

. . . for Continental Boilers are frequently *lowest* in purchase cost, yet feature highest quality workmanship, materials and controls.

SAVE FUEL COSTS!

. . . for Continental Radiant Flame Heating meets or beats other methods for fast, economical heat. And its unique "Spinning Gas Technique" affords maximum heat transfer and efficiency.

SAVE TIME, LABOR, MAINTENANCE!

. . . through Continental Boiler's simple, functional design that affords quick access to furnace and return tubes, easy cleaning and inspection, brief shut-down.

SAVE REPAIR AND REPLACEMENT COSTS!

Long, trouble-free service is made possible because all return tubes do equal work, affording balanced water circulation and uniform expansion.

Sizes 20 to 500 hp, 15 to 250 psi. Gas, oil or combination fired. Write for literature, and let B.E. bid on the next boiler you need.

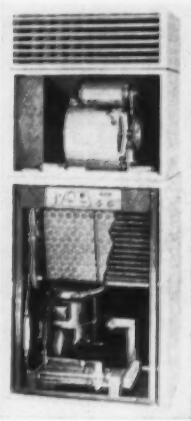
Continental AUTOMATIC BOILERS

BOILER ENGINEERING and Supply Company, Inc.

1 Manavon St. • Phoenixville, Pa. • Phone 5832

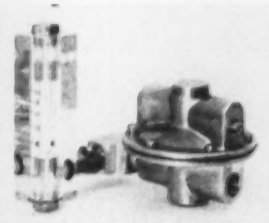
EQUIPMENT DEVELOPMENTS

Continued



HPAC, 2525 N. Clybourn Ave., Chicago.

In 2, 3, 5 ton sizes, both air and water cooled. Cited feature is 163 separate air flow combinations. Units built in three sections: hermetically sealed cooling system; blower section, which can be mounted in variety of ways; plenum chamber, which provides for proper air discharge.



Differential Regulator . . .

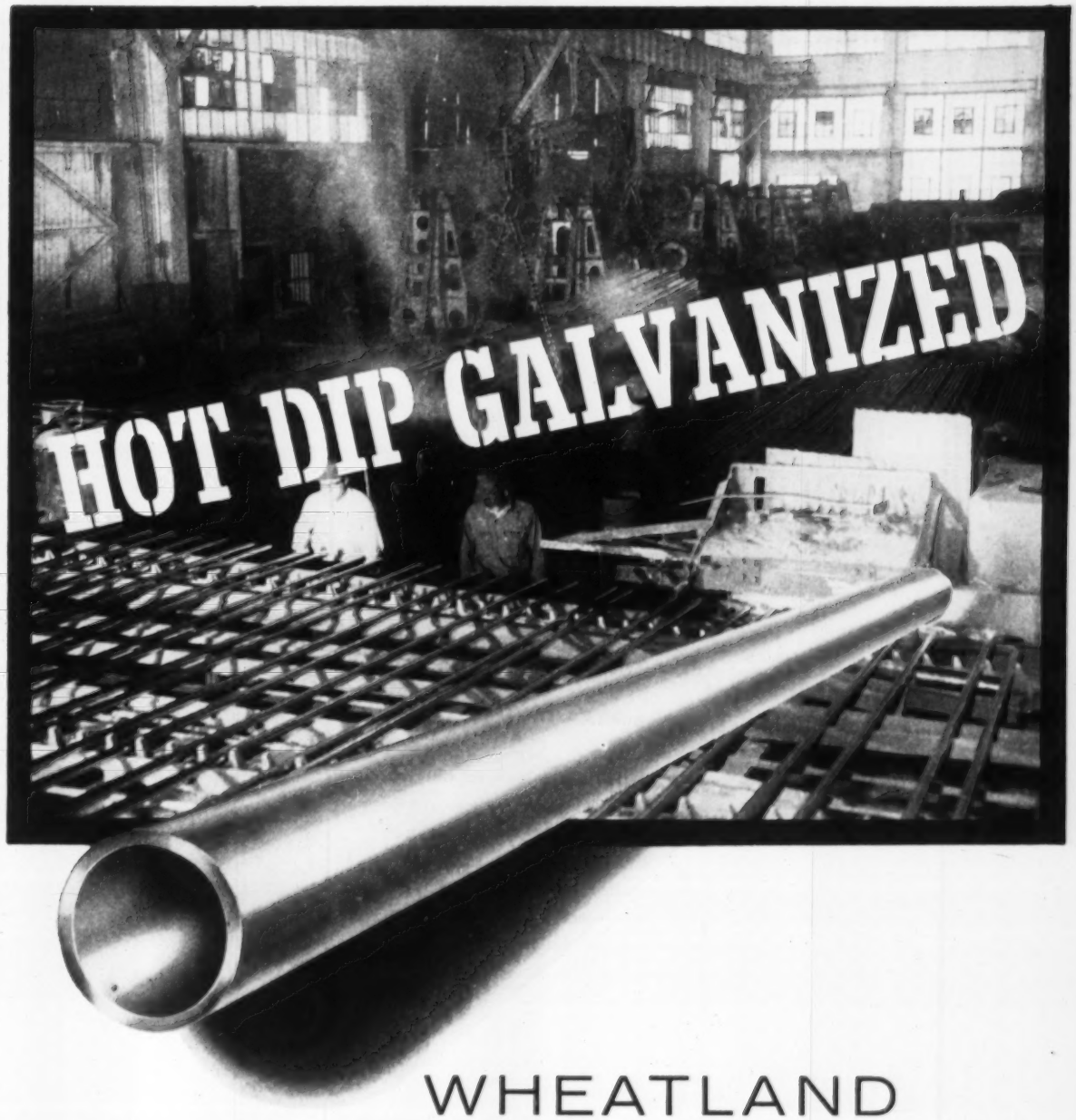
. . . with integral needle valve—*Comoflow Corp., Dept. HPAC, 2100 Arch St., Philadelphia 3.*

For purging with air, water, gas, in services where actual measurement of flow is unnecessary. Can also be supplied in combination with small flow rate indicator as complete purge meter package. Ranges 0.2 to 2.0 scfh of air, 20 to 200 cc per min of water available.

Air Conditioners . . .

. . . in new series added to company's 1956 line—*Fresh'nd-Aire Co., Div. of Cory Corp., Dept. HPAC, 221 N. LaSalle St., Chicago 1.*

Featuring push-button controls, flush mounting, thermostat, "full



WHEATLAND

Each length of **WHEATLAND** Steel Pipe takes a dip in a vat of Molten Prime Western Zinc.

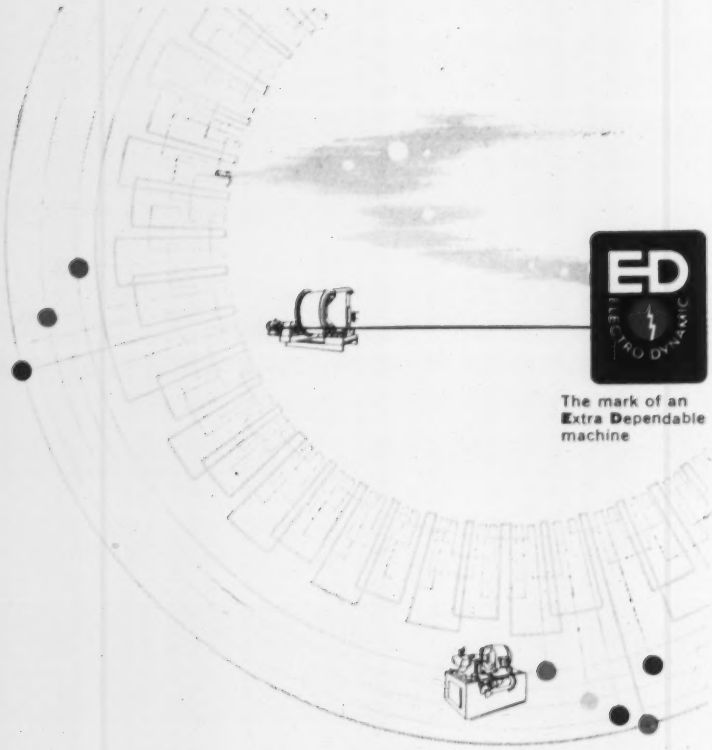
Each operation is performed, individually to insure a complete protective coating, inside and out.

Each length of the "pipe with the year mark" is cleaned to remove all foreign substances from its surfaces to insure the galvanizing of a perfect alloy with the base metal.

Each length is individually "blown out" so that there is no accumulation in the inside area.

For longer, lasting protection, for ease in operation—specify **WHEATLAND** Hot Dip Galvanized Steel Pipe.

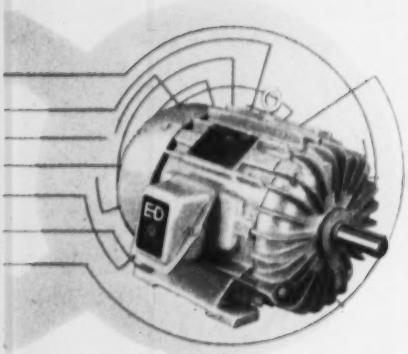
WHEATLAND TUBE COMPANY · BANKERS SECURITIES BLDG., PHILA. 7, PA. · **MILLS**: WHEATLAND, PA., DELAIR, N.J.



The mark of an **E**xtra **D**ependable machine

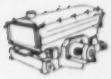
a better kind of power

FOR INDUSTRIAL MACHINES



1 to 250 hp. AC and DC. N.E.M.A. standards.

Extra starting and anti-stalling capacity: Extra cool, extra quiet operation: Achieved without sacrifice of full-load efficiency. Backed by unparalleled experience, E.D. motors are *extra dependable*—75 years in the making—yours today *at no extra cost!*



ELECTRO *xtra* **DYNAMIC** *ependable motors*

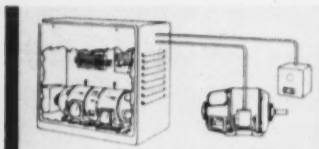
GD

PRODUCT OF GENERAL DYNAMICS

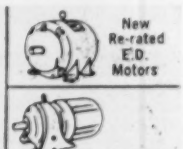
NEW...

Write for Brochure 100 and literature on new E.D. motors and drives.

Electro Dynamic division of General Dynamics Corporation Bayonne, New Jersey



E.D. "Selectrol" Variable Speed Drives



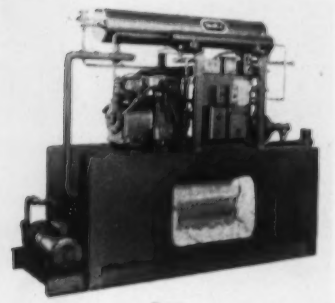
New Re-rated E.D. Motors

Gear-ED-motors

EQUIPMENT DEVELOPMENTS

Continued

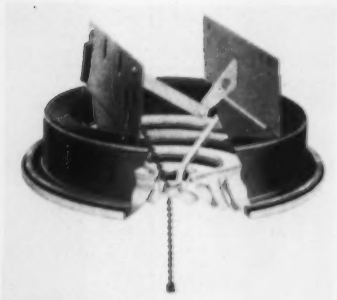
width cooling," "Constellation" line available in ¾, 1, 1½, 2 hp models.



Packaged Chillers . . .

. . . with storage tanks—*Heat-X, Inc., Dept. HPAC, Brewster, N.Y.*

Recommended by company for application where peak demand conditions occur; in supplying drinking water for schools, hospitals, theaters, offices, etc., and for variety of industrial applications. Feature "Inner-Fin" construction with insulated stainless steel tanks.



Ceiling Diffuser . . .

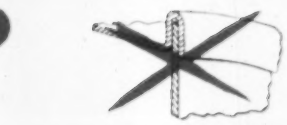
. . . for heating, cooling—*Lima Register Co., Dept. HPAC, Lima, Ohio.*

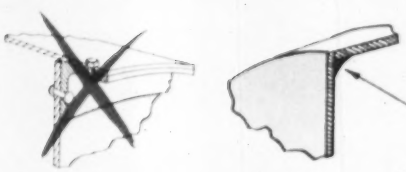
With curved contour step-down rings without straight edge. Design is said to assure maximum free area, efficient distribution of supply air in all directions. Damper assembly has built-in mechanical spring loaded butterfly dampers, said to provide full center opening, full shutoff. In seven sizes 6 to 22 in.

Electronic Device . . .

. . . for controlling conductivity of solutions—*Fielden Instrument Div., Robertshaw-Fulton Controls Co.,*

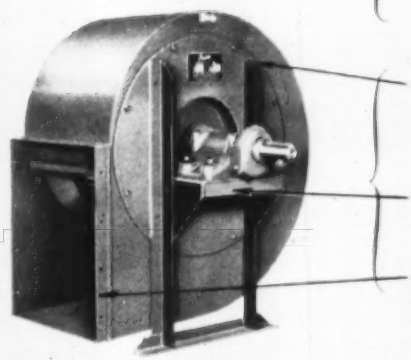
Bayley FAN-A-GRAFICS
For Equipment Engineers



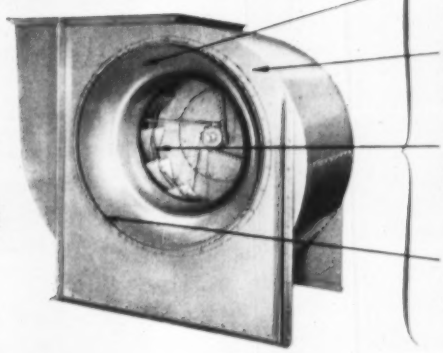


Craftsmanship

Presented here for your information are some basic facts revealing how superior quality Fans are built by a manufacturer credited with a long history of fine craftsmanship in production.



FEATURE	FUNCTION	BAYLEY Standards
Strong, tight, continuous inside-welded housing seams, with smooth, neat exterior.	To avoid leaks, springing, warping, crinkling, vibration. Easily painted or insulated for seamless, trouble-free protection.	All types and sizes of fabricated steel housings.
Reversible Housing	Quickly available for any discharge position, permits field changes, simplifies or eliminates detailed preliminary layouts.	Type F and AP Fans to size 365 inclusive. Other styles to maximum practical.
Fabricated Brackets	Durability, maximum strength-weight ratio, matched to specific load requirements.	All types and sizes except very small fans.
Reinforced, system-ready outlet piece.	Quickly-made, tight connections. No "field manufacturing" required.	All types and sizes.



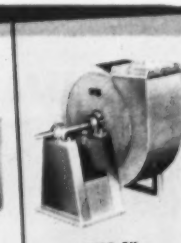
Smooth-spun, closely fitted Housing and Wheel Inlets.	Minimize turbulence and recirculation losses, provide maximum *realized* efficiency.	All AP Fans.
Ample Housing Side and Scroll Gauges (Made practical and effective by seam-welding.)	Uniformly high strength, stiffness, and corrosion resistance minimizes "breathing", vibration, perforation.	All types and sizes.
Accurately Prepared and Applied Wheel Blade and Shroud Reinforcement.	Maximum strength with minimum shaft load reduces moment of inertia, facilitates precision balance, minimizes vibration.	Type F and AP Wheels, according to size and speed.
System-ready Inlet Ring of ample length and stiffness.	Facilitates quick connection to inlet duct or accessory, originally or at a *later time*. System can be altered or extended without reconstructing or modifying fan.	All types and sizes. (Need not be explicitly specified.)

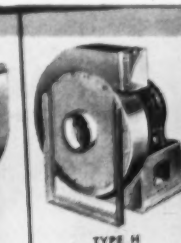
You'll find all these as well as many other quality features in BAYLEY Fans.
Send for Complete Line Bulletin CL-551.
Our 100th Anniversary of Craftsmanship

PLEXIFORM
Forward Curve

AEROPLEX
Backward Curve

VENTILATING SET

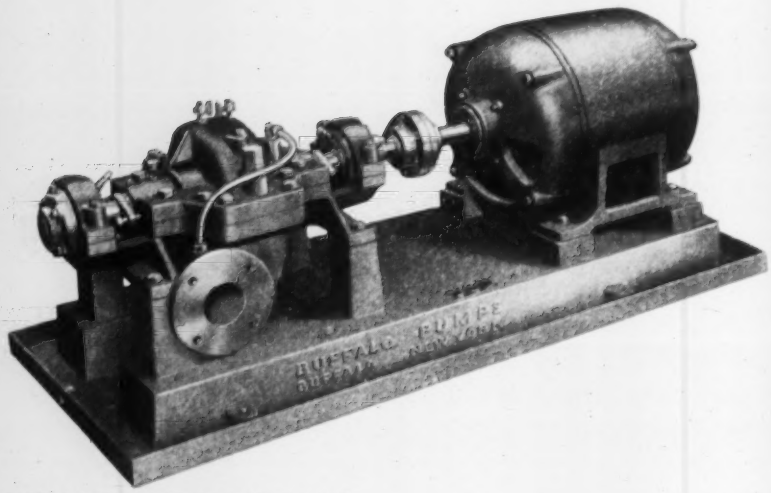

TYPE EX
Industrial Fan


TYPE H
Pressure Blower

Engineered
AIR HANDLING EQUIPMENT

BAYLEY BLOWER COMPANY

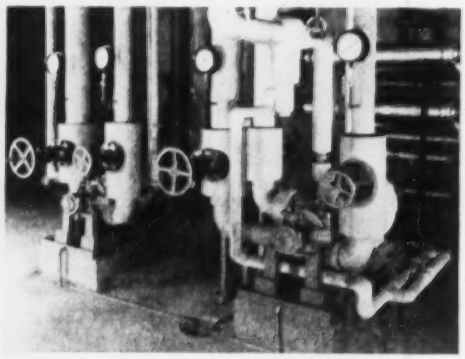
6600 West Burnham Street
Milwaukee, Wisconsin



"BUFFALO" MULTISTAGE PUMPS

"MADE-TO-ORDER" for BOILER FEED!

These time-proved pumps are delivering clear water at high temperatures against pressures up to 500 psi — doing it efficiently and on a trouble-free basis. Consider a typical example — the 5" 2-stage "Buffalo" RR Pump delivering 400 gpm against 500 ft. head at 3500 rpm — an efficiency of 75%. Yes, these pumps are made-to-order for your boiler feed or other high pressure jobs. Bulletin 980 gives you all the engineering details and "Q" Factor* features that add up to satisfaction when you specify "Buffalo" for the job. Write for your copy today!



"Buffalo" Type RR Pumps giving efficient performance day in and day out in a large boiler installation where continued high pressure is vital.

**The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.*

"Buffalo" PUMPS

BUFFALO PUMPS

DIVISION OF BUFFALO FORGE COMPANY

171 MORTIMER ST. • BUFFALO, N. Y.

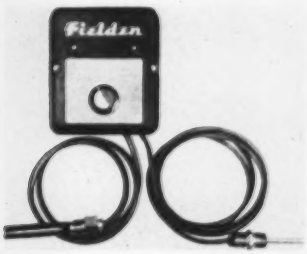
Canada Pumps, Ltd., Kitchener, Ont.

Sales Representatives in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

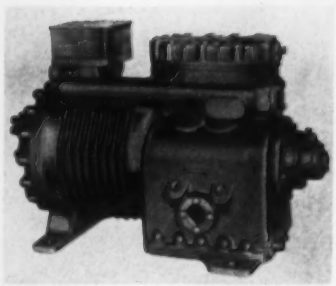
EQUIPMENT DEVELOPMENTS

Continued



Dept. HPAC, 2920 N. Fourth St., Philadelphia 33.

For use where recording not required. Designed for simplified use and operation, unit has two zone action for alarm or control. In two standard ranges of conductivity: 0 to 30 micro-ohms/cm³, or 20 to 200 micro-ohms/cm³, for use with conductivity cells having constant of 1.



10 Hp Compressor . . .

. . . designed for air conditioning application added to company's line—*Copeland Refrigeration Corp., Dept. HPAC, Sidney, Ohio.*

Measures 27 3/16 in. long, 13 1/2 in. high, 14 in. wide. Cfh displacement is 1375 at 1750 rpm. Design includes three cylinders with bore 2 3/16 in., stroke 2 in. Refrigerant is fluorinated hydrocarbon (No. 22). Refrigerant cools motor windings to eliminate cooling fans, water connections.

Electronic Thermostat . . .

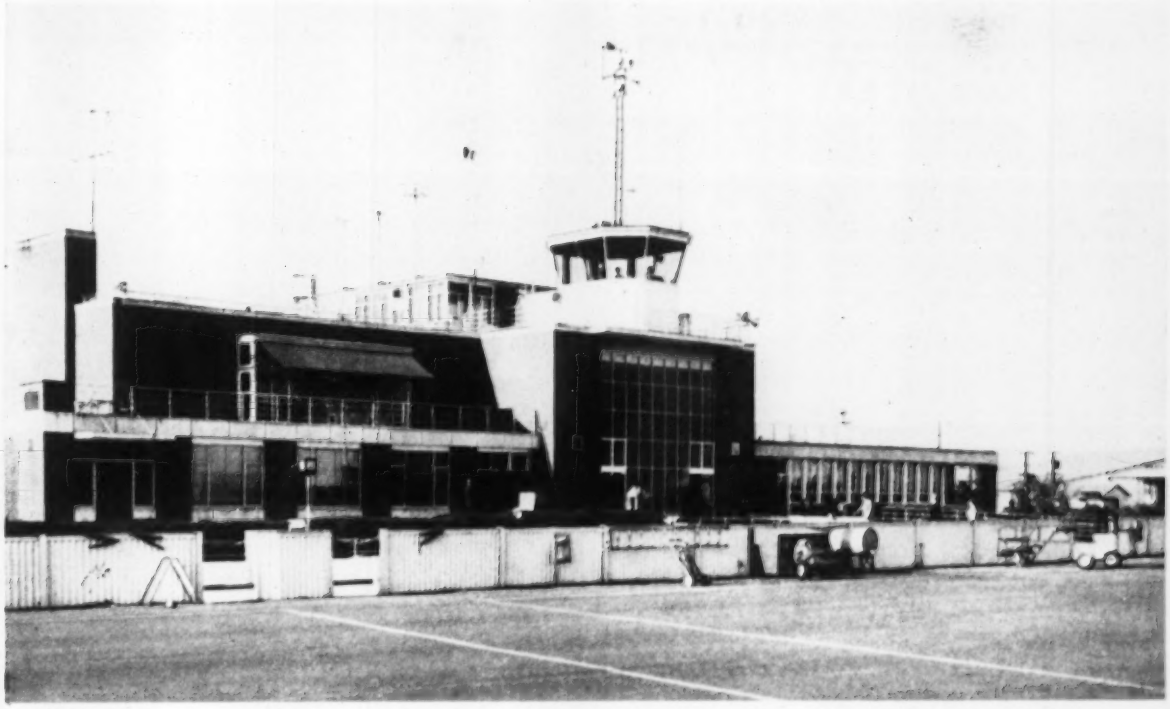
. . . with 27 ft temperature sensing element—*Minneapolis-Honeywell Regulator Co., Dept. HPAC, 2641 Fourth Ave., S., Minneapolis 8.*

Designed to solve problem of temperature stratification in large air ducts. Temperature sensing wire en-

WILL-BURT STOKERS

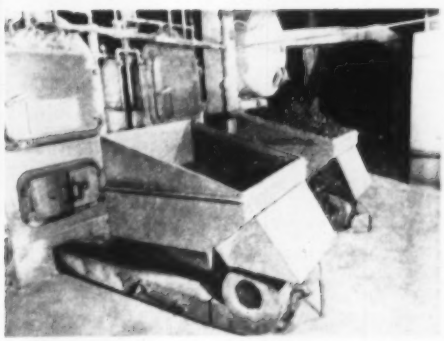
AT SMITH REYNOLDS AIRPORT

WINSTON-SALEM, NORTH CAROLINA



". . . silent, untiring partners for 15 years"

SAYS ROBERT K. JOERGER,
AIRPORT MANAGER



Will-Burt Stokers, installed 1940.

ARCHITECT: Hall Crews, Winston-Salem, North Carolina
CONTRACTOR: Sam E. Beck, Inc., Winston-Salem, North Carolina
DISTRIBUTOR: Atlas Supply Co., Winston-Salem, North Carolina

It's a great satisfaction to have such comments from a Will-Burt owner – particularly when we consider the difficult heating problem presented here. Doors opening constantly, a completely exposed building, lots of glassed-in area – yet Mr. Joerger says, "Will-Burt Stokers have been silent, untiring, economical partners in our successful effort to keep our passengers and tenants comfortable in the severest weather".

We don't cite this as an unusual case. Our purpose is to call your attention to the kind of service we know Will-Burt Stokers will give.

Find out about Will-Burt Stokers, Automatic Air Control, and Panel Board stoker "automation". Write for our brochure, "The Logic of Stoker Heating". A stoker heating manual, with installation diagrams and suggested specifications is also available.

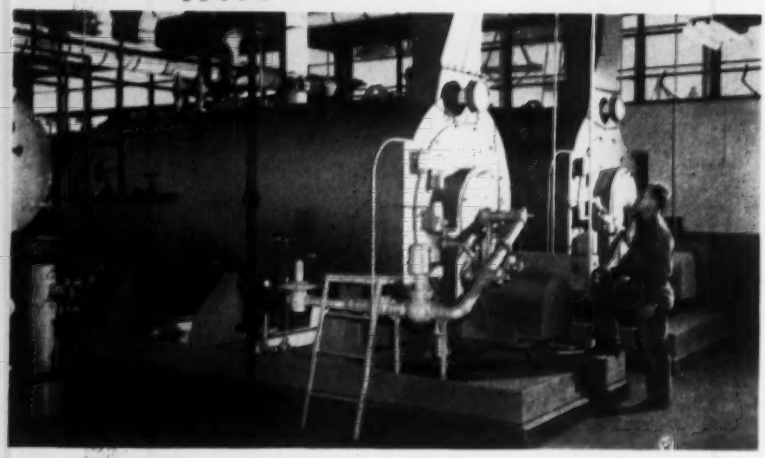
The WILL-BURT Company

OUR TWENTY-SEVENTH YEAR IN THE STOKER BUSINESS

P.O. BOX 902, ORRVILLE, OHIO

THERE'S $5,949.81 WORTH of READING

IN THIS STORY CYCLOTHERM WROTE!



Too high—said the Zion Cooperative Mercantile Institute, Salt Lake City, of its 1953-1954 heating costs. ZCMI is the largest wholesale distributor in the intermountain area.

So ZCMI installed two Cyclotherm Steam Generators (150 and 250 hp). And from October, 1954 to June, 1955, even in a colder winter and with additions to the ZCMI plant, Cyclotherm saved ZCMI $5,949.81.

For full information on how ZCMI saved money with Cyclotherm—together with a month-by-month before-and-after table of ZCMI's heating costs—write to Cyclotherm today. You'll join the thousands of satisfied Cyclotherm users who report *more heat with less fuel*.

In Cyclotherm Cyclonic Combustion, air combines with fuel to form a vortex of flame, revolving at 200 miles per hour, providing maximum heat transfer. Cyclotherm is a complete package steam or hot water generator, 5 connections make it ready to work. From 18 to 500 hp, 15 to 200 psi. Meets all state requirements, A.S.M.E. and National Board Standards, is approved by Underwriters Laboratories, Inc. Write for complete booklet on Cyclotherm Cyclonic Combustion today.

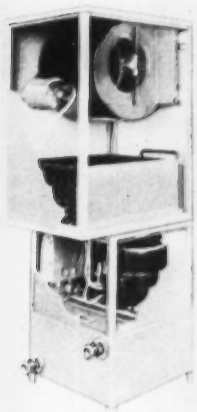
YEARS AHEAD IN STEAM GENERATION CYCLOTHERM

CYCLOTHERM DIVISION
NATIONAL-U.S. RADIATOR CORP.
Dept. 2628 Oswego, N.Y.

EQUIPMENT DEVELOPMENTS

Continued

closed in ⅛ in. copper tubing. Unit can also be used to give average reading of concrete slab temperatures in radiant floor panel heating systems. Operating range is —30 to 225 F.



Water Chiller . . .

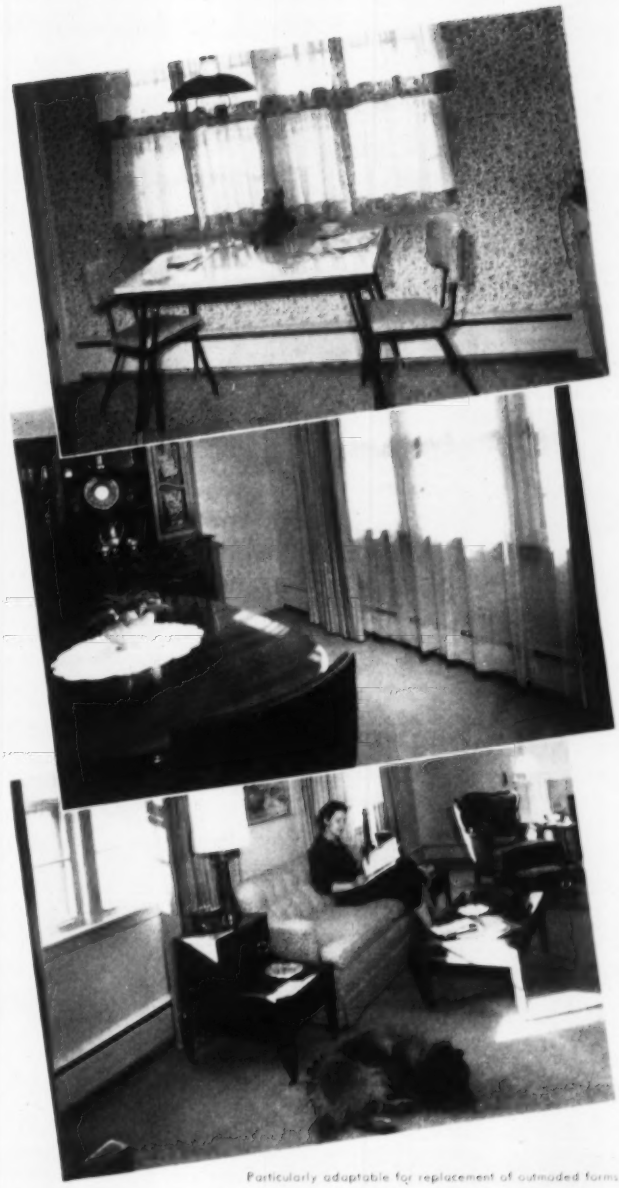
. . . engineered for flexibility of installation, designed to require less than 4 sq ft floor area—*Drayer Hanson, Inc., Dept. HPAC, 3301 Medford St., Los Angeles 63.*

Recommended by company for commercial, industrial applications. Available with water cooled or air cooled condensers (shown). Available are 2, 3 ton models. Larger capacity models expected shortly, manufacturer reports.

Soldering Flux . . .

. . . for copper, copper alloys—*Hi-Grade Alloy Corp., Dept. HPAC, 1236 S. Talman, Chicago 8.*

"Hi-Grade No. 29" formulated to decompose during soldering, leaving parts free of flux residues. Is said to have wetting, penetrating action that flows deep into cracks to facilitate lasting bond.



Particularly adaptable for replacement of outmoded forms of heating in this year's national modernization campaign.

ECONOMICAL

Beauty

with PROFITS, TOO!

KRITZER "K" LINE

Radiant Baseboard

"K" Line is the custom line, specially created by KRITZER design engineers to blend with the clean, open design of today's homes.

"K" Line offers permanent built-in beauty with economy for buyers. Engineered features permit lowest installation time with extra profit for contractors. KRITZER quality means greater sales value for the home . . . greater all 'round satisfaction for you and your customers.

For clean, dependable, quiet heating . . . for safe, straight line beauty . . . for more decorating and living space . . . specify "K" Line!

Available in sizes and capacities to meet any heating need. Engineering data—Bulletin 200. Consumer bulletin—907.

KRITZER RADIANT COILS, INC.
2901 Lawrence Ave. • Chicago 25

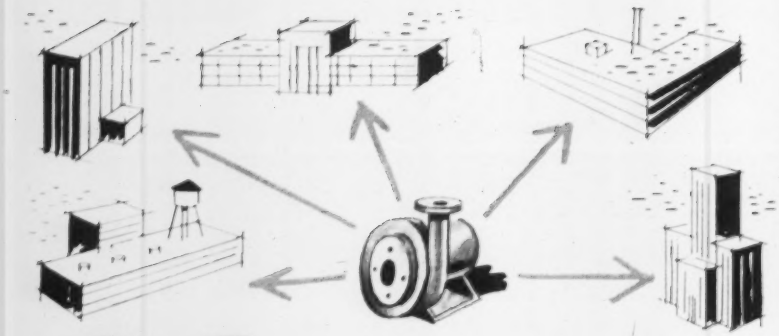
KRITZER QUALITY HEATING PRODUCTS

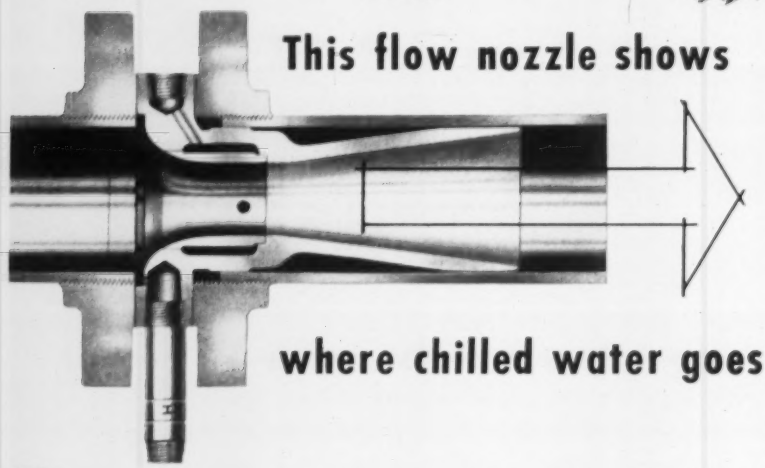
"K" LINE BASEBOARD | SLOPE TOP BASEBOARD | STANDARD BASEBOARD | UNIVERSAL BASEBOARD | CONVECTOR, SLOTTED FRONT | KRITZER FINNED TUBE

REPRESENTATIVES IN PRINCIPAL CITIES
SEE YOUR JOBBER FOR KRITZER PRODUCTS

KRITZER

"IF IT'S KRITZER, IT'S RIGHT, SIR!"





This flow nozzle shows

where chilled water goes

BIF Builders-Providence, Inc., leading manufacturer of flow nozzles and tubes, offers the Model NZIF Insert Nozzle as a real money-maker in air conditioning systems. Commercial buildings, shopping centers, and other multiple occupant buildings find this precision nozzle the ideal metering element for accurate measurement of chilled water usage.

Here's why this flow nozzle is so widely accepted:

PRESSURE/TEMPERATURE PROOF: insert design withstands same pressures and thermal shocks as pipe itself.

ENDURING ACCURACY: precision machining throughout bronze throat liner and contoured inlet. Perpendicularly drilled and reamed piezometer taps.

LOW HEAD LOSS: efficient Venturi outlet cone assures high pressure-head recovery — permits use of smaller pumps, motors, piping.

EASY INSTALLATION: pressure taps are built-in . . . no special measurements or machining required in field.

MULTIPLE THROAT VENTS: for accurate metering even with upstream flow disturbances.

Bulletin 130-K3A gives complete dimension, capacity, and other data . . . shows how easy it is to install this efficient flow nozzle . . . gives detailed accuracy and pressure recovery information. Write for your copy to BUILDERS-PROVIDENCE, INC., 381 Harris Ave., Providence 1, Rhode Island.

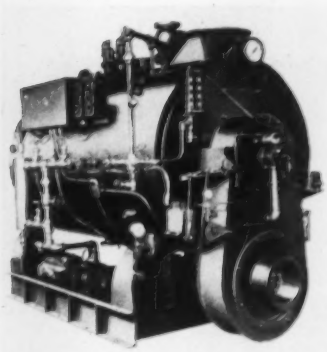
B-I-F INDUSTRIES

PROVIDENCE, RHODE ISLAND

BIF METERS FEEDERS CONTROLS

EQUIPMENT DEVELOPMENTS

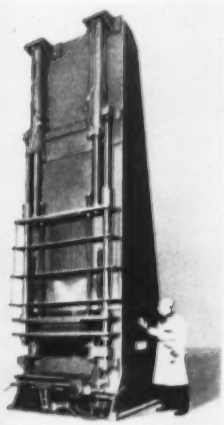
Continued



Steam Generator . . .

. . . designed to deliver 5000 lb per hr of steam from 8 × 7 ft floor area — *Cyclotherm Div., National-U. S. Radiator Corp., Dept. HPAC, 157 E. First St., Oswego, N.Y.*

Oil pump set assembly furnished factory-installed under unit. Water treatment tanks mounted on side of boiler shell, piped to feedwater pump system. Bypass piping permits manually controlled water circulation. Unit is dry land adaptation of company's marine steam generator.



Expander . . .

. . . for air conditioning coils engineered to expand, size metal tubing in finned coil assemblies to 72 in. long — *Walter P. Hill, Inc., Dept. HPAC, 22133 Telegraph Rd., Detroit 19.*

Has inclined frame designed to provide ease of loading at floor level. Utilizes hydraulic power to expand

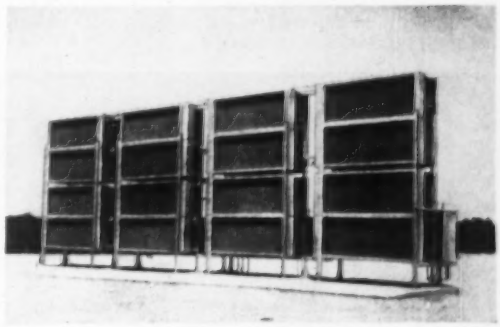
100 TON BARRIER

Crashing the 100 ton barrier

with KRAMER

UNICON

in semi-tropical climate



UNICON SUCCESSFULLY MET THE TEST THROUGH THE SEVERE SUMMER OF 1955

You, too, can crash the big tonnage barriers with UNICON, the industry's finest remote-type air-cooled condenser. Put Kramer's 18 years of "treasured know-how" in the proper use of air as a condenser coolant to work for you.

Photo of Kramer UNICONS mounted on roof of Handy-Andy Supermarket in San Antonio, Texas, used with 100 ton air conditioning system. Supplied through United Supply Co., of San Antonio and installed under the direction of Harold Vogt.

Write for Bulletin U-210-L

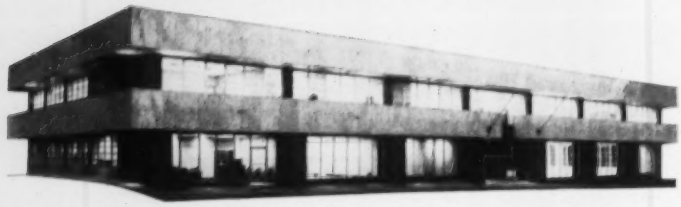
KRAMER

KRAMER TRENTON COMPANY
Trenton 5, New Jersey

In the new Dallas Insurance Center . . .

Flexible *Thermaflex*®

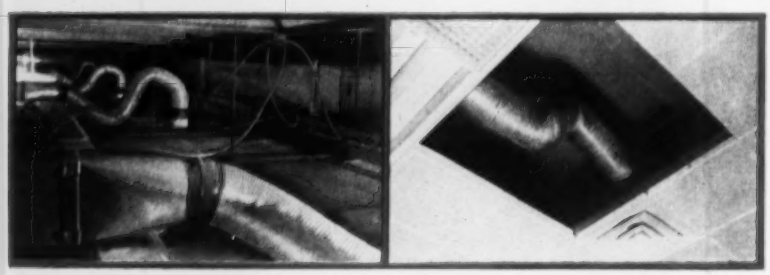
keeps floor plans flexible, too!



George L. Dahl, Architects & Engineers; O'Rourke Construction Co., General Contractor; United American Insurance Co., Owner—all of Dallas

Rigid ducting couldn't handle this job!

To allow for future rearrangement of offices, ceiling diffusers in the new Dallas Insurance Center had to be readily moveable! They are — because the architects and contractors installed flexible Thermaflex. Diffusers can be moved four feet in any direction without disconnecting Thermaflex — no complicated tearing out and refitting of rigid ducting will be needed.



You can see the flexibility assured by Thermaflex as runouts from main ducts to ceiling diffusers. This lightweight, durable, easy-to-handle metallic-laminate ducting is contributing a great deal to the usefulness of this new building over a long period of years. This installation is a conventional low pressure system. Thermaflex was used in 5", 6", 8" and 10" diameters. It is available in diameters up to 12 inches.

Laboratory tests have proved that Thermaflex will stand 1200° F. without any sign of combustion or melting — that it will stand pressure of 25 psi, which is 5x minimum standards of the New York Board of Standards and Appeals. Thermaflex bends around corners and obstructions with minimum friction loss . . . installs quickly and easily . . . eliminates costly elbows and special fittings.

Flexible Tubing

CORPORATION

GUILFORD, CONNECTICUT • LOS ANGELES 64, CALIFORNIA

Send the coupon today! Our engineers will show you how Thermaflex can save you up to 32% on installation costs.

Flexible Tubing Corporation, Dept. 7 Guilford, Connecticut
Please send me more information on Thermaflex.

Name_____

Title and Company_____

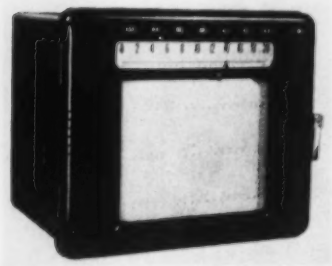
Address_____

City_____ Zone____ State_____

EQUIPMENT DEVELOPMENTS

Continued

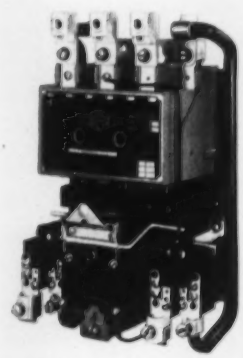
condenser tubes, size ends for soldered return bends by forcing expansion mandrels through tubes.



Potentiometer-Recorder . .

. . .engineered for high accuracy, simple operation, minimum maintenance—*Wheelco Instruments Div., Barber-Colman Co., Dept. HPAC, Rockford, Ill.*

"Series 3000" electronic unit is of null-balancing type. Selfcontained unit requires only external sensing device, company says. In range of models which measure, indicate, control, record such variables as temperature, speed, strain, hydrogen ion, other quantities that can be resolved into electrical signals.



Electric Motor Starter . . .

. . .in size 1 engineered with three basic design advantages—*Furnas Electric Co., Dept. HPAC, 1011 McKee St., Batavia, Ill.*

Cited advantages are: compactness (size 1 is only slightly larger than size 3); standardized design (noncurrent carrying elements interchangeable with size 3); dual purpose (reconnectable dual voltage coils).

Get in on the best training program in packaged air conditioning!

York's new training course took years to develop, but there's nothing like it in the industry! You'll be taught by factory-trained experts. You'll learn everything you need to know about packaged air conditioners—how to sell, install and service them—and you won't have to be an engineer to follow what's going on. Get complete details. See your York distributor, or mail this coupon today!

Manager of Sales, Commercial Division
York Corporation, York, Pa.

Tell me how York's new training program for Yorkaire dealers will put more dollars in my pocket.

Name _____

Company _____

Address _____

City _____ Zone _____ State _____

HPM

York refrigeration air conditioning gives you more training...more models...more quality...more profits!

You name it, York makes it! Waterless and water-cooled units from 2 hp. to 15 hp.; models for off the floor, through the wall, remote, and multi-space installations. York has the answer to every air-conditioning problem.

Greater cooling capacity with no increase in power consumption—that's York's sensational Hi-Ef cooling system! New Sealed Air Circuit (exclusive on 3, 5 and 7½ hp. models) keeps motor heat out of cool air flow.

York's hermetically sealed cooling system means "packaged" construction—no field charging, no tubes to run, no field fabrication. There are no expansion valves to get out of order, no gasketed joints—no major service problems that cause profits to go down the drain.

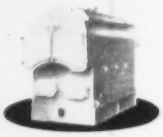
Find out about the *Yorkaire Big 4*—four dynamically new selling approaches that will send your sales and profits soaring! Get in touch with your nearest Yorkaire distributor, or mail the coupon today!

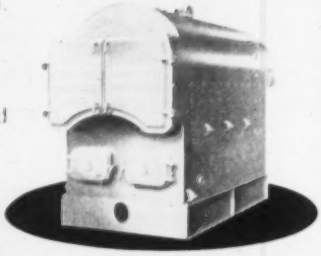
York refrigeration air conditioning *the quality name in air conditioning*

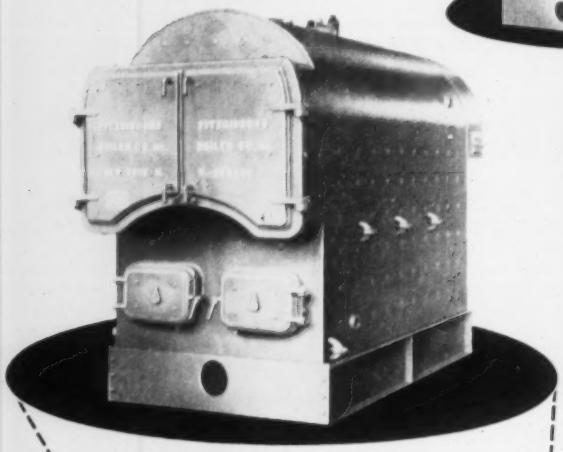
Another FITZGIBBONS STEEL BOILER for this expanding school

BECAUSE THEY PERFORM UP TO EXPECTATIONS, Fitzgibbons Boilers are re-specified time and again by satisfied architects, engineers and building owners. In the case of this modern school in Lunenburg, Mass., a Fitzgibbons "D" Type Firebox Boiler was installed when the building was first erected. A subsequent addition to the school called for another Fitzgibbons Boiler. Now a third Fitzgibbons gets the call for another addition. It all adds up to a solid performance record, right in keeping with "the best in steel boiler heat." — FITZGIBBONS.

For complete information on "big building" heating boilers, including complete, packaged units, write for SW 56, Fitzgibbons Boiler Company, Inc., 101 Park Avenue, New York 17, N. Y.







SBI

Architect:
Harry J. Korsland
Norwood, Mass.

Engineer:
Buckel & Company, Inc.
Boston, Mass.

Heating Contractor:
J. G. Lamotte & Son, Inc.
Worcester, Mass.

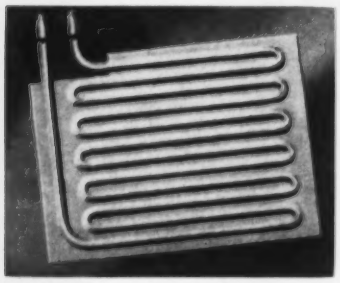
Lunenburg Junior Senior High School, Lunenburg, Mass.

SINCE 1886

The Fitzgibbons Boiler®

EQUIPMENT DEVELOPMENTS

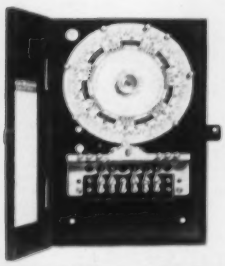
Continued



Heat Transfer Units . . .

. . . featuring serpentine construction, "at-the-top" connections—*Tranter Mfg., Inc., Dept. HPAC, Lansing, Mich.*

"Platecoils" designed for industrial processes requiring application or removal of heat. Right angle inlet, outlet fittings on style "50" units make them especially suitable for use in open top tanks, says company. In 18 or 22 in. widths; lengths are 23 to 119 in.



7-Day Time Switch . . .

. . . designed to regulate complex weekly programs involving one to six daily on-off operations — *General Controls Co., Dept. HPAC, Skokie, Ill.*

Applications include control of heating, ventilating, air conditioning systems. Each day's schedule independent of every other day's, says company. Available with self starting, synchronous motor or seven-day hand wound spring.

Electrode, Filler Wire . . .

. . . formulated to enable welder to lay sound, high quality bead—*International Nickel Co., Inc., Dept. HPAC, 67 Wall St., New York 5.*

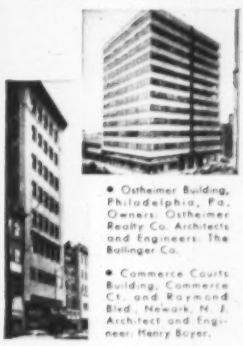
Electrodes available in 3/32, 1/8,

W-S FORGED STEEL UNIONS...

EQUIPMENT DEVELOPMENTS

"What my clients worry about is Maintenance!"

AIRTEMP INSTALLATIONS



• Ostheimer Building, Philadelphia, Pa. Owners: Ostheimer Realty Co. Architects and Engineers: The Ballinger Co.

• Commerce Courts Building, Commerce Ct. and Raymond Blvd., Newark, N. J. Architect and Engineer: Henry Boyer.

Airtemp AIR CONDITIONING IS CHRYSLER-ENGINEERED TO GIVE TROUBLE-FREE SERVICE

Yes, once the air conditioning installation is made, you and your clients want quiet, *trouble-free* operation from then on—with no complaints! And that's what Airtemp's Chrysler engineering assures. Here you have the pioneers in packaged air conditioning putting all their skill and knowledge into your installation. Here you have the advanced principles of engineering leadership at your command for advice, consultation and application.

Airtemp cuts maintenance to the bone. You receive all the advantages of peak performance at lowest price. We'd like to explain them in detail. Without obligation on your part, write: Airtemp Construction Corporation, Dayton 1, Ohio.

Airtemp
CONSTRUCTION CORPORATION
SUBSIDIARY OF CHRYSLER CORP.

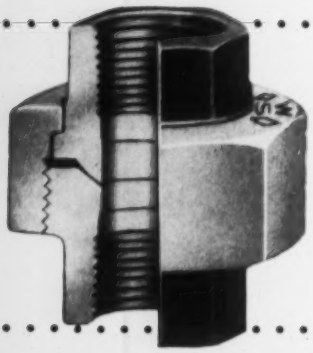
THE *FORWARD* LOOK

IN AIR CONDITIONING • HEATING FOR HOMES, BUSINESS, INDUSTRY

KEENEY IS HEADQUARTERS

W-S FORGED STEEL UNIONS...

These Features are
YOUR GUARANTEE of a Safe,
Tight Union Connection:



1. FORGED STEEL CONSTRUCTION—
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2. SPHERICAL-TO-ANGLE MATING SURFACES
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W-S Forged Steel Unions give you the kind of protection you need in high pressure piping systems. They're designed with precision-machined spherical-to-angle mating surfaces for positive seating, free from leaks even when pipes are slightly out of line. Cadmium-plated nuts resist galling and seizing and forged steel construction gives you the extra strength you need in high pressure service.

W-S Unions are available in 3000 lb. class, sizes ⅛" to 3" in screw-end and socket-welding types. Send today for your copy of Bulletin U-1.

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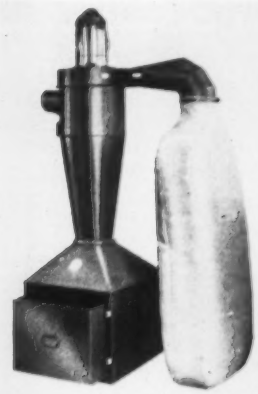
EQUIPMENT DEVELOPMENTS

Continued

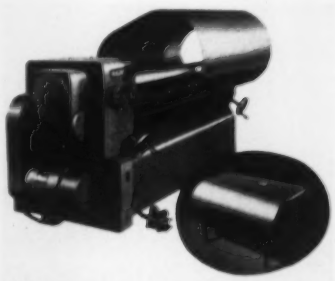
5/32, 3/16 in. diameters. Filler wire in 0.035, 0.045, 0.062 in. diameters for inert gas welding consumable process; in 36 in. straightened lengths for tungsten-arc process and in same diameters as electrodes.



Dust Collectors . . .

. . . equipped with "Dacron" after-filter bags—*Torit Mfg. Co., Dept. HPAC, 287 Walnut St., St. Paul 2.*

Tests showed cloth would not burn when exposed to shower of sparks, says company, also, would not shrink when laundered. By using after-filters, user can recirculate cleaned, heated air indoors, where regulations permit, instead of exhausting it out of doors, thereby reducing heating costs, according to manufacturer.



Slip Roll Formers . . .

. . . built in modified models for forming obround, rectangular shapes —*Niagara Machine & Tool Works, Dept. HPAC, 683 Northland Ave., Buffalo, 11.*

Both power, hand operated machines can be equipped with new feature, says company. Designed to

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An all-new second edition presenting practical heating data reprinted from *Heating, Piping and Air Conditioning*. An inspiring record of 37 foremost heating specialists' experiences. Actual installations that proved most efficient for hotels, stores, office buildings, hospitals, banks, churches, schools and colleges. Methods for enlarging or modernizing old systems—maintenance—fuel saving—sizing piping—temperature and boiler control—stopping building heat leaks, etc. Full, 8½" by 11" size. A lot for your money.

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• INDUSTRIAL AIR CONDITIONING HANDBOOK

Information on the purpose, cost, design, operation and maintenance of process and comfort air conditioning systems in manufacturing plants of many kinds. The combined knowledge and experiences of 33 prominent engineers, every one a designer or in direct charge of the largest factory air conditioning systems in operation. This shows other engineers how air conditioning helps speed production, improve products, and increase worker efficiency . . . also how to operate conditioning systems as economically as possible. If improvements and savings in any plant's air conditioning operations are possible, these data and ideas from other plants will certainly suggest the ways to make them.

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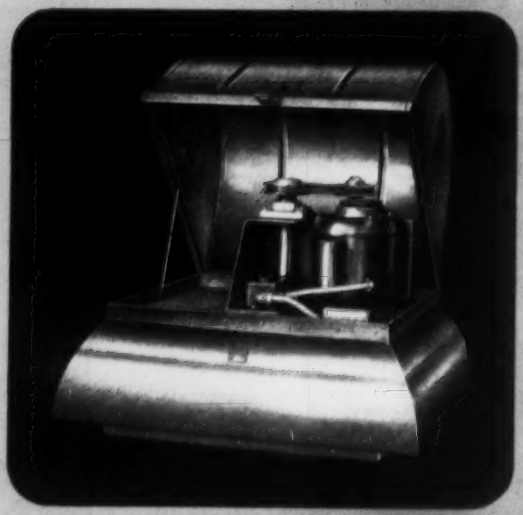

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ALADDIN Centrifugal Roof Ventilators are furnished in thirteen sizes . . . direct and belt driven. Ruggedly built, these units have been designed especially for those installations where positive year around powered ventilation is required.

ALADDIN Roof Ventilators are described in the first complete engineering bulletin yet published on similar units. This bulletin contains full performance tables, characteristic curves and other data required for the proper selection of such equipment.

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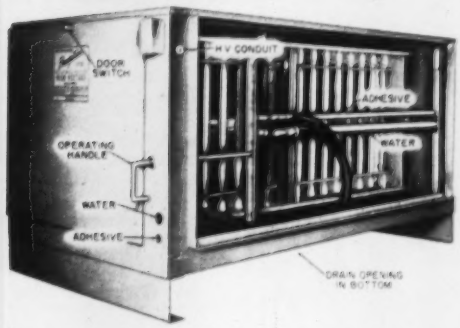
1111 WEST AVENUE 137 - SAN LEANDRO, CALIF.
REPRESENTATIVES IN ALL PRINCIPAL CITIES IN THE WEST

EQUIPMENT DEVELOPMENTS

Continued

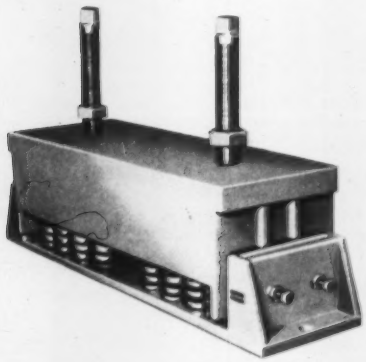
alternately produce curved, flat surfaces for production of obround tanks, containers, round cornered rectangular pipe sections, similar objects.



Air Cleaner . . .

. . . for commercial, industrial application—*Starrevant Div., Westinghouse Electric Corp., Dept. HPAC, 200 Readville St., Hyde Park, Boston 36.*

Packaged "Precipitron" unit incorporates movable washing and adhesive applications, requires space of only 33 in. in direction of air flow, says company. Application cycles controlled, operated from outside unit. Unit comes fully enclosed with built-in drain pan, drain connection, duct flanges. Can be ceiling, floor, platform mounted. Capacities range 200 to 10,640 cfm.

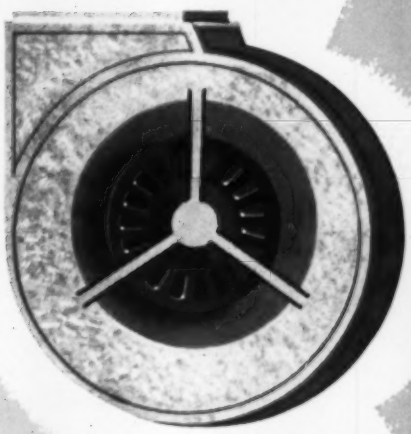


Vibration Isolator . . .

. . . engineered to permit direct mounting of "heaviest" machinery without special chasses or foundations—*Korfund Co., Inc., Dept. HPAC, 43-01F 32nd Pl., Long Island City 1, N. Y.*

"SK 50,000 Vibro-Isolator" rated 75,000 lb for steady running applications, 50,000 lb for impact applications. Units consist of welded steel housing containing oil tempered, high carbon or chrome-vanadium helical steel springs as isolation medium.

any shape...any size... any kind of ductwork is better with galvanized steel... is best with



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In manufacturing ductwork, galvanized steel has long been relied on for ease and economy of fabrication . . . also providing maintenance-free long life.

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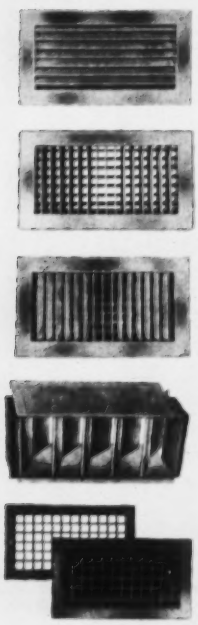

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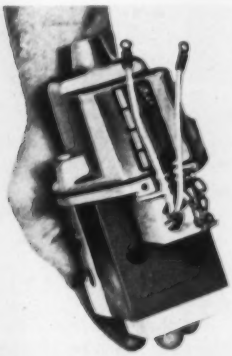
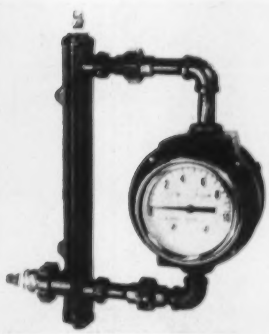
Continued



Multipurpose Valve . . .

. . . designed for wide range of air, oil pressure applications—*Ross Operating Valve Co., Dept. HPAC, Detroit.*

Is said to be fast operating, compact, lightweight aluminum valve. Available with $\frac{1}{4}$ or $\frac{3}{8}$ in. pipe tap for in-line, manifold or base mounting; in single solenoid spring return, double solenoid momentary and double solenoid three position.



Vane Type Flowmeter . . .

. . . for air, gas flow—*Scully-Jones & Co., Dept. HPAC, 1901 S. Rockwell St., Chicago 8.*

Engineered for constant pressure drop across meter. For indicating, controlling, signal alarm, safety shut-off, sequence starting or shutdown. In three body sizes with standard scale diameters $4\frac{1}{2}$, 6 in.

Deep-Cut Hole Saws . . .

. . . designed for fast boring of holes through most materials—*Millers Falls Co., Dept. HPAC, Greenfield, Mass.*

Kit includes six saws in sizes 1

CLEAN AIR ELECTRONICALLY

THE Electro-STAYNEW WAY

• **Eliminate SMOKE, AIRBORNE DUST, POLLEN**

IN ALL TYPES OF VENTILATING SYSTEMS

WITH Electro-STAYNEW PRECIPITATORS

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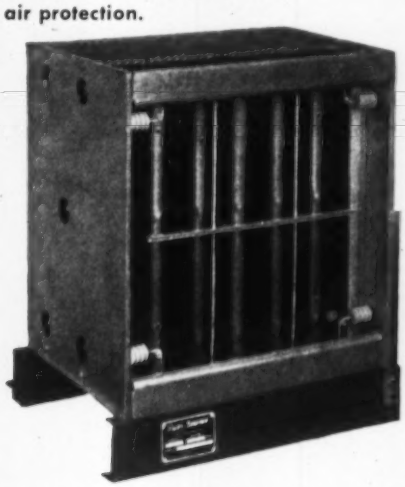
Give your plant tested, economical clean air protection.



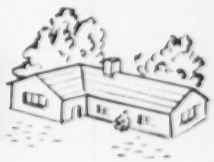
Based on the "electrostatic principle of precipitation", (+) charged dirt drawn to (−) charged collector plates, Electro-Staynew *removes more than 90% of dirt particles* and returns clean air. Dust, smoke, soot and microscopic particles (as small as 1/250,000 of an inch in diameter) are removed. Electro-Staynew improves efficiency, quality-control, and its extremely low maintenance cost makes operation economical.

Unclean Air

Mechanically Clean Air

Electronically Clean Air

for the HOME



Announcing An Electro-Staynew For A More Comfortable Home!

Easily installed in any forced air circulating system, the compact Electro-Staynew Home Precipitator distributes air with *over 90% dust, dirt, pollen removed.* The *same electrostatic filtration* used so successfully in other Electro-Staynew units will reduce cleaning and fuel costs. The Electro-Staynew Home Precipitator brings symptomatic relief to persons allergic to airborne particles. It's economical to operate . . . actually uses less current than a 50 Watt light bulb!

Operates on standard electric house current.

No moving parts to get out of order.

Write for Bulletin
400—Electro-Staynew Industrial Precipitator
Bulletin 440—Electro-Staynew Home Precipitator

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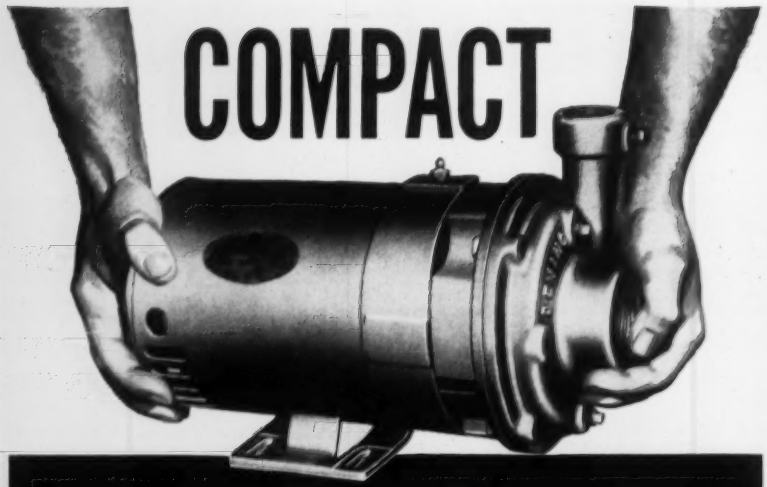

POWERFUL

New Deming "Motor Mount" Pumps for AIR CONDITIONING

Designed for air conditioning service, these compact, dependable Deming "Motor-Mount" Centrifugal Pumps offer you high quality units at minimum cost.

Suction and discharge nozzles are integral with casing which may be turned to give either horizontal or vertical positions of the discharge nozzle.

Construction features include all-bronze, enclosed type impeller; stainless steel shaft; mechanical, rotary type shaft seal; and ball bearing, single or three phase motor equipped with grease lubrication for bearings.

Capacities range from 5 through 140 G.P.M. with heads from 10 through 140 feet at 3500 R.P.M.

In addition to air conditioning applications, these versatile pumps are also efficient units for booster service, general circulating service, swimming pools, lawn sprinkling and industrial plant service.

When writing for further details, please ask for BULLETIN NO. 4355B.

THE DEMING CO. • 560 BROADWAY • SALEM, OHIO

CALL YOUR **DEMING DISTRIBUTOR** *for help on pumps!*

EQUIPMENT DEVELOPMENTS

Continued

1/16 to 2 9/16 in. diameter. Saws have cutting edges four teeth per inch of high speed steel welded to chrome-vanadium body. Cut depth is 2½ in. Kit also includes two mandrels, each with 7/16 in. hex shanks, ⅜ in. pilot drills.

Gas Indicators . . .

. . . with portable design for detecting, measuring flammable gases, vapors — *Mine Safety Appliances Co., Dept. HPAC, 201 N. Braddock Ave., Pittsburgh 8.*

Four models, each for specific functions, included in line. All have same size, use standard detector and compensator filament units. Shown is application of one unit, used to check atmosphere in manhole.

Dial Calibrated Level . . .

. . . operating on semi-floating needle principle — *Pickett Products, Inc., Dept. HPAC, 1111 S. Fremont Ave., Alhambra, Calif.*

Calibrated to measure degrees off-level or plumb. Designed to measure verticals, horizontals, angles, slopes, pitches. Reverse side measures inch rise per foot.

Lunkenheimer Announces

ANOTHER GREAT NEW LQ600 VALVE

200 Lb. S.P.! 400 Lb. W.O.G.!

Lunkenheimer's famous LQ600, the Bronze Globe Valve that set a new high standard of performance on 150 lb. service, is now available for 200 lb. S.P., 400 lb. W.O.G. applications. The new line features the same long-wearing flat seats and discs made of Brinalloy®, plus a body and bonnet of Lunkenheimer's amazingly strong S-1 Bronze for higher-pressure service. Install this great new LQ600 Valve on your 200-lb. pressure lines—including all your toughest services—and compare its performance with other valves. It's built to eliminate maintenance costs because there is no replacement of seats and discs—they are patented Brinalloy, brazed in to stay, harder all the way through and more resistant to wear and corrosion than 500 Brinell Stainless Steel and far exceeding the wear resistance of 1000 Brinell case-hardened Stainless Steel.

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Now there are *TWO* LQ 600 Valve Lines

The original LQ600 Valve for 150 lb. S.P., 300 lb. W.O.G. service has received the fastest acceptance of any valve introduced in years. Thousands of these valves are in service—some as long as five years—without a single reported case of failure or leakage.

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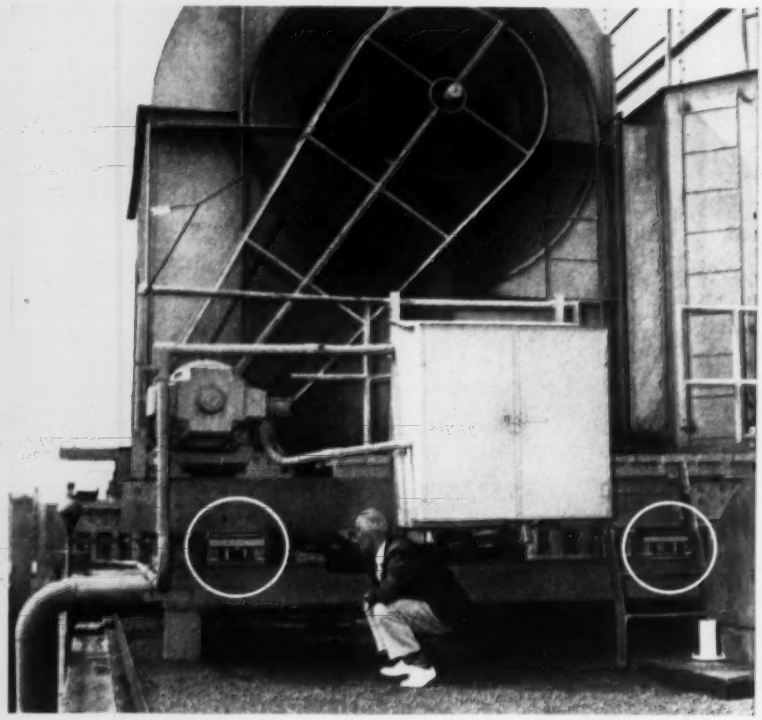
VIBRATION CONTROL



Means MORE ROOMS FOR RENT

The ability to utilize every inch of available space is sometimes the difference between profit and loss in building management.

The photo shows a fan installation on the roof of a famous hotel. Until the Korfund Steel-Spring Vibro-Isolators were installed, twenty rooms on the floor below could not be rented because of vibration. Even water standing in drinking glasses showed a decided side-to-side movement. The simple rubber pads installed previously just couldn't do the job.

Correcting faulty vibration control installations such as this, and recommending the right way the first time is made possible by experience. Korfund has more than a half-century of experience in the vibration control field. So when you have a problem, bring it to Korfund—you'll get impartial recommendations on media, whether it be springs, rubber, or cork, alone or in combination. Our experience will tell us which is best for you. And after all, there is no substitute for experience. Korfund can help you solve your vibration problem.

Write for a copy of the booklet "Air-Conditioning Goes Up in the World" which tells how to increase profits through vibration-free upper floor installations. Ask for Bulletin 32.

For specific recommendations, contact us or one of the 46 local Korfund offices. Look under "Korfund" in your local Telephone Directory or in Thomas' Register.

KORFUND VIBRATION CONTROL — SPRINGS — RUBBER — CORK

THE KORFUND CO., INC.

48-01F Thirty Second Place, Long Island City 1, N. Y.

In Canada: 510 Canal Bank, Ville St. Pierre, Montreal

EQUIPMENT DEVELOPMENTS

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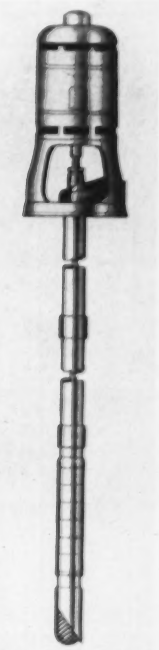


Packaged Pump . . .

. . . designed for wells as small as 4 in. in diameter. *Layne & Bowler Co., Dept. HPAC, 2943 Vail Ave., Los Angeles 22.*

"Verti-Line" units available in sizes 2 to 7½ hp, heads to 340 ft, capacities 200 to 7500 gph. In 4, 6 in. sizes.

Automobile Conditioner. . .

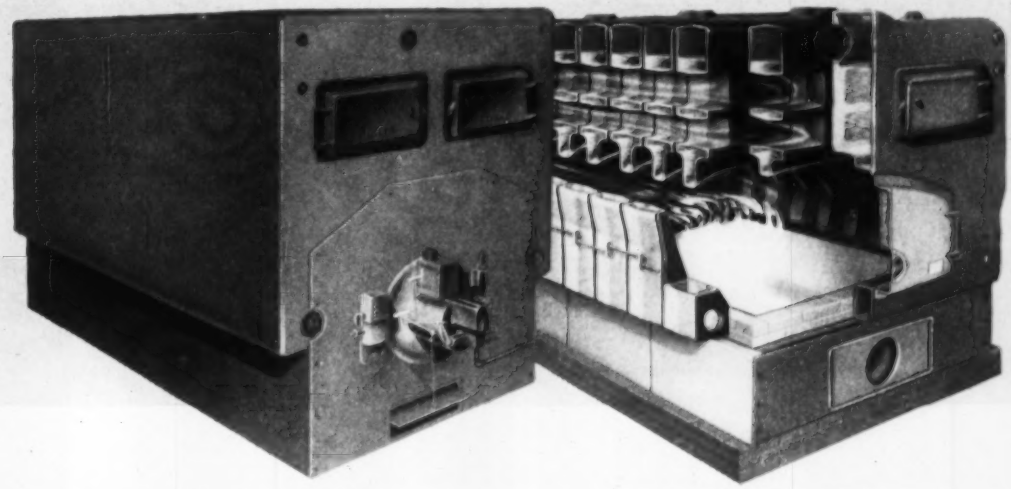
. . . designed for mounting either under dash or in trunk. *Kool Engineering Corp., Dept. HPAC, 3716 W. Belmont Ave., Chicago 18.*

Cooling cabinet has multispeed blower. Adjustable louvers direct cooled air to any part of car, says company. Rubber hose connections used throughout. Cabinet measures 8 in. high, 13½ in. long, 7½ in. deep.

FOR HEAVY DUTY

AT LESS COST

Savings in installation, boiler room space, maintenance and operating cost are a few of the reasons why Weil-McLain Heavy Duty Boilers have achieved a reputation for low cost, dependable service. These boilers are ideal for both new buildings and replacement jobs and offer many efficiency features unequalled by competitive makes.



HR SERIES BOILERS

FOR HORIZONTAL ROTARY OIL BURNERS

In the HR Series, Weil-McLain makes a notable advance in boiler design. They are ASME constructed, *cast iron* units, engineered to provide the best operating conditions for burning low-cost, heavy oils. These boilers were designed in cooperation with leading makers of horizontal rotary oil burners and have their approval.

The HR Boiler is distinguished by numerous exclusive features. Its large firebox volume develops better combustion conditions and assures maximum radiant heat transfer. The high base makes more combustion space available—eliminates a high brick foundation. A special steel front plate simplifies installation of rotary burners and the heavily insulated steel jacket saves insulating time.

For complete information send for Bulletin C-188.

40 AND 44 SERIES BOILERS

FOR OIL, GAS AND STOKER FIRING

These heavy duty boilers are noted for efficient performance, ease of installation, minimum servicing requirements and long life. They have an excellent reputation for economical operation in institutional, commercial and industrial installations.

Extra primary heating surface and balanced gas travel in the flueways assure maximum radiant and convected heat transfer. The base may be extended to provide the additional space required by automatic firing.

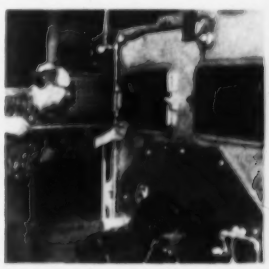
Short draw-rod construction permits rapid assembly and simplifies the adding of sections if enlarged capacity is required. Sectional construction also permits boiler erection without special equipment. Weil-McLain Series 40 and 44 Boilers can be readily converted from one fuel to another. Send for Bulletin C-186!

All Weil-McLain Heavy Duty Cast Iron Boilers have these *"Extra Value"* features

When installing or adding capacity to boiler, sections can be moved through an ordinary door.

Joining the sections by short draw-rods simplifies erection and makes a strain-free assembly.

For boiler replacement or in adding to boiler capacity, sectional construction makes installation easier.



Generously sized clean-out doors give complete access to flueways—easy to keep boiler at top efficiency.

WEIL-McLAIN MICHIGAN CITY, INDIANA

WEIL-McLAIN BOILERS · RADIATORS

Address literature requests to Dept. AA-56

EQUIPMENT DEVELOPMENTS

Continued

Air Meter . . .

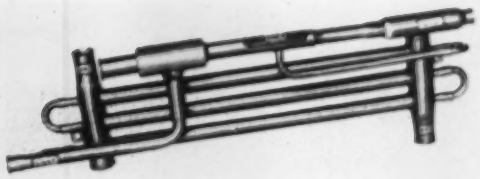
. . . designed for measuring minute air flow movements with high degree of accuracy—*Hastings Instrument Co., Inc., Dept. HPAC, Hampton, Va.*

With range of 0 to 30 mph, and logarithmic type meter scale, unit is said to assure readability below 5 mph and high accuracy below 1 mph. Operates on 90-135 volts a-c, 60 cycles.

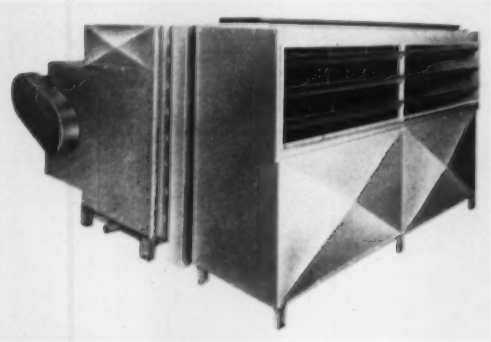
Pressure Stabilizers . . .

. . . designed to maintain head pressure on air conditioning, refrigeration systems where evaporative or air cooled condensers required to operate in low ambient temperatures—*Bush Mfg. Co., Dept. HPAC, West Hartford, Conn.*

Can also be applied to systems using cooling towers where water regulating valves not used, says company. Unit incorporates heat transfer mechanism which



transfers heat from hot gas discharge of compressor to sub-cooled liquid leaving condenser when pressure drop across regulating valve causes liquid to pass through heat transfer section.



Cabinet Type Air Conditioners . . .

. . . designed to cool, dehumidify, heat, humidify, clean air—*Worthington Corp., Dept. HPAC, Harrison, N.J.*

Engineered to distribute air from either central

Everybody NEEDS THIS NEW REED CHAIN WRENCH

Ratchet action works either way from either side

IDEAL FOR CLOSE QUARTERS

works where an ordinary pipe wrench won't!

The Reed DU-ALL Chain Wrench does everything a conventional pipe wrench will do, and a great deal more. It gets into tight corners, close to baseboards or between parallel pipe lines, and holds round, square or irregular shapes . . . firmly, without "play" or crushing.

Its fast, ratchet action lets you tighten and "back off" without taking the wrench from the pipe.

All sizes of the DU-ALL wrench have ample chain length for fully tightening pipe up to the diameters handled by ordinary wrenches of equal lengths. Additional chain in the 14" model, however, gives the wrench a full working capacity up to 2" pipe and a holding capacity up to 4 inches. This is a major convenience in lining up soil pipe stacks, straightening studs, setting posts or turning any irregular shape within the leverage range of the 14" handle.

Whenever you want to work with pipe . . . ask for a REED Pipe Tool!

REED MANUFACTURING COMPANY Erie, Pennsylvania

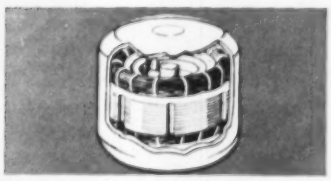
. . . make installation easier, cut costs

Install a blower with a Delco Products direct drive motor on your next blower job. This simplified blower design with fewer moving parts makes possible a more compact, lighter weight installation requiring less maintenance. Best of all, it costs less.

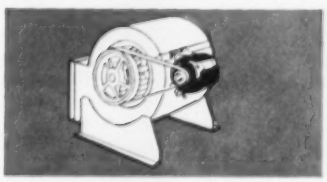
You can get direct drive blowers equipped with four different basic types of Delco Products motors: shaded pole, extended winding, permanent split-capacitor, and split-phase. In this wide selection of designs and models there is a motor to meet every application and power requirement.

Every blower powered by a Delco Products direct drive blower motor has been carefully engineered by both Delco Products and the blower manufacturer to give long life and economical operation. Delco Products maintains service stations from coast to coast and throughout the world for quick, competent, reliable service.

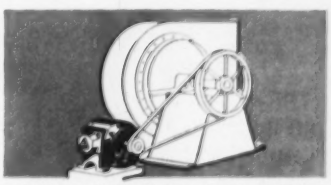
For assistance on any motor problem, contact your nearby Delco Products Sales Office or Delco Products, Dayton, Ohio.



DELCO PRODUCTS HERMETIC MOTORS for refrigeration compressors. Four-pole models, 1/12 to 10 h.p. Two-pole models, 1/8 through 15 h.p.



DELCO PRODUCTS BELT DRIVE MOTORS. Split-phase, capacitor-start, and polyphase fhp models for fans, blowers and compressors.



DELCO PRODUCTS POLYPHASE INTEGRAL HP MOTORS in rerated NEMA frames now provide more power per pound.

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DELCO *Electric* MOTORS

DELCO PRODUCTS, DIVISION OF GENERAL MOTORS, DAYTON, OHIO

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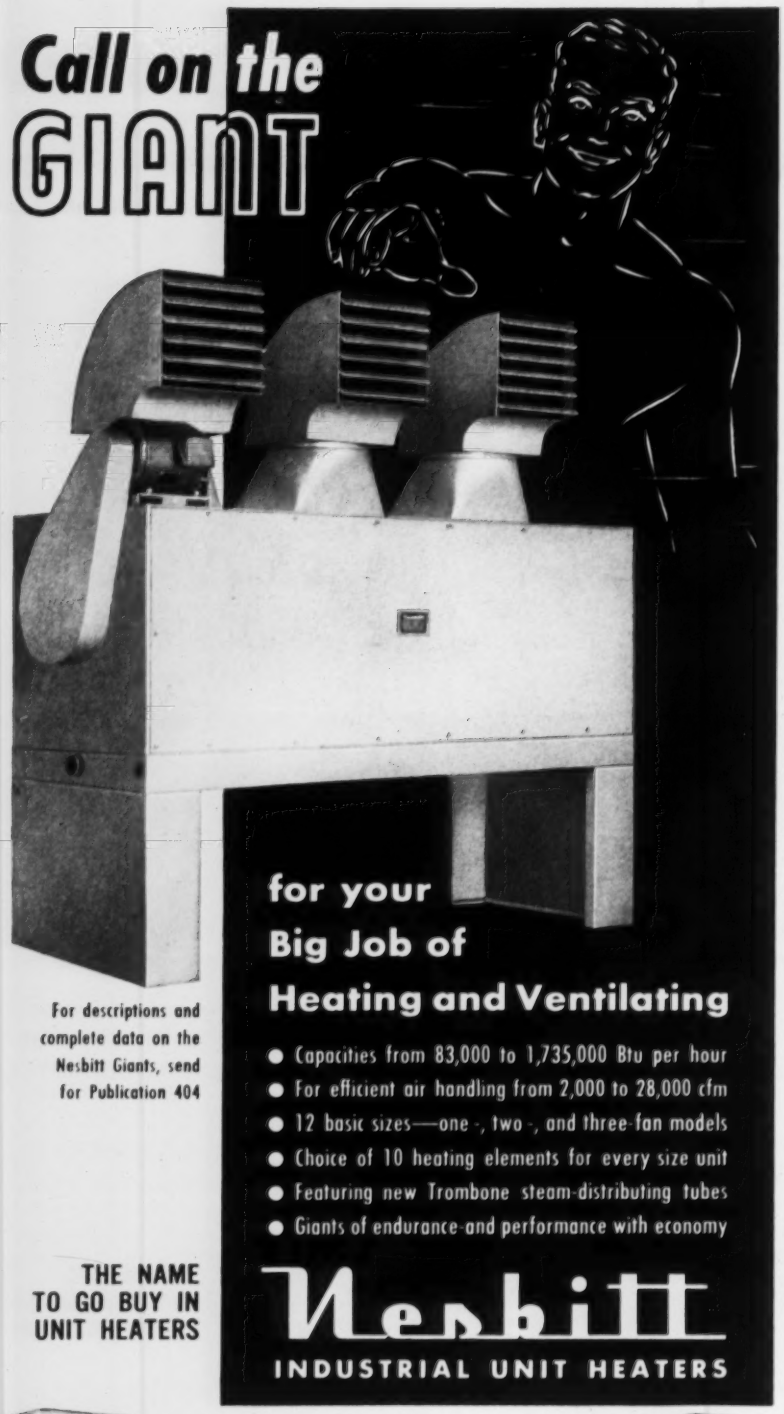
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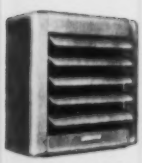
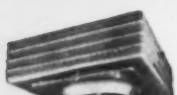
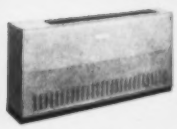


PROPELLER FAN UNIT HEATERS



LITTLE GIANT UNIT HEATERS



SERIES C UNIT HEATERS

GAS FIRED UNIT HEATERS

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EQUIPMENT DEVELOPMENTS

Continued

refrigeration or heating system. Cited feature is flexibility and compact arrangement which solves space problems as interchangeable panels permit any preferred air discharge, intake. Motor mounting, fan location may be positioned in front, top, back of unit. For stores, apartment buildings, hotels, large factories, etc. In 10 sizes 1 ½ to 100 tons capacity.

Tank Fill Safety Signal . . .

. . . for fuel oil storage tanks—*OPW Corp., Dept. HPAC, 2735 Colerain Ave., Cincinnati 25.*

Whistle sounds constantly while tank is being filled. Stops when liquid level in tank reaches bottom of tube. Tank always fills to proper level, says company, leaving safety expansion zone.

Heat Transfer Units . . .

. . . available in special alloys formulated to extend their application in corrosive, highly acid, other specialized industrial processes — *Tranter Mfg., Inc., Dept. HPAC, Lansing 4, Mich.*

Alloys include: type 314 stainless steel, monel, Carpenter 20, Hastelloy "B" and "C", nickel.

Air Conditioners . . .

. . . for casement window installation —*Frederick-Aire Co., Div. of Cory Corp., 221 N. LaSalle St., Chicago.*

In ¾, 1 hp models. Cited features

How to Select an Economical Temperature Regulator

First of all, what does *economy* mean where temperature regulators are concerned? In some industries it means improvement of product or reduction of spoilage through closer control of process temperatures. In others, it means the paring down of operating expense. The price of the regulator itself is a relatively small factor.

Today's buyers are shopping for:

1. Accuracy of control — not only when the regulator is new, but throughout its service life
2. Dependability — to prevent loss of production time
3. Minimum installation and maintenance cost

Here are a few tips on what to look for when you're installing a new or replacing an old temperature regulator —

Packless construction . . . and for this reason: A diaphragm operated, packless regulator minimizes friction. There are no closely fitted parts to stick or bind because of uneven expansion or collection of foreign matter. Also, there's less maintenance, since no repacking is ever required.

A guarantee against wire drawing of the seats and discs. Insist on it. This guarantee in combination with single seat design assures you of tight shutoff; you avoid expensive steam losses as well as loss of product in a process application.

Broad control range. In a standard regulator you should expect a control range of 100 F. And make sure the unit you select has a vapor tension thermostat that can take over-temperatures of at least 100 F.

Easy maintenance. Why ask for grief? Your temperature regulator should be basically simple in design so that it can be serviced by average plant personnel. All parts should be readily accessible for testing and cleaning.

Double duty. There's no point in buying a separate pressure regulator when you can select a temperature regulator that combines both temperature and pressure control within the same unit.

Self-operating. Make sure you get a regulator that operates on its own initial pressure. By doing so, you avoid the purchasing and maintenance of an air compressor plus air piping, and you're sure of uninterrupted operation during electric power failures.

• • • •

All of these points are important to you when it comes to selecting an economical temperature regulator. Perhaps you didn't realize you could expect so much. And perhaps you didn't realize that Spence Temperature Regulators offer all these features and more. May we send you our Bulletin T-500 containing further details?

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. . . use Chicago
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EQUIPMENT DEVELOPMENTS

Continued

are: push-button controls, "automatic" thermostat, full width "V" cooling, optional diffusion, filtering.

Steam Trap . . .

. . . with larger integral strainer—*Armstrong Machine Works, Dept. HPAC, Three Rivers, Mich.*

Strainer designed to protect trap from sediment, scale, other foreign particles in steam lines. Trap for use at pressures to 250 psi. Capacity is 3500 to 4400 lb per hr of condensate.

Convector . . .

. . . with large steel tubes—*Embassy Steel Products, Inc., Dept. HPAC, 390 Stanley Ave., Brooklyn.*

Designed to permit condensate to return in element while steam is entering, so it may be used on one pipe steam system. Can be used on all steam, hot water systems, says company. Available in 144 sizes, with capacities 9 to 101 sq ft EDR.

Portable Electric Humidifier . . .

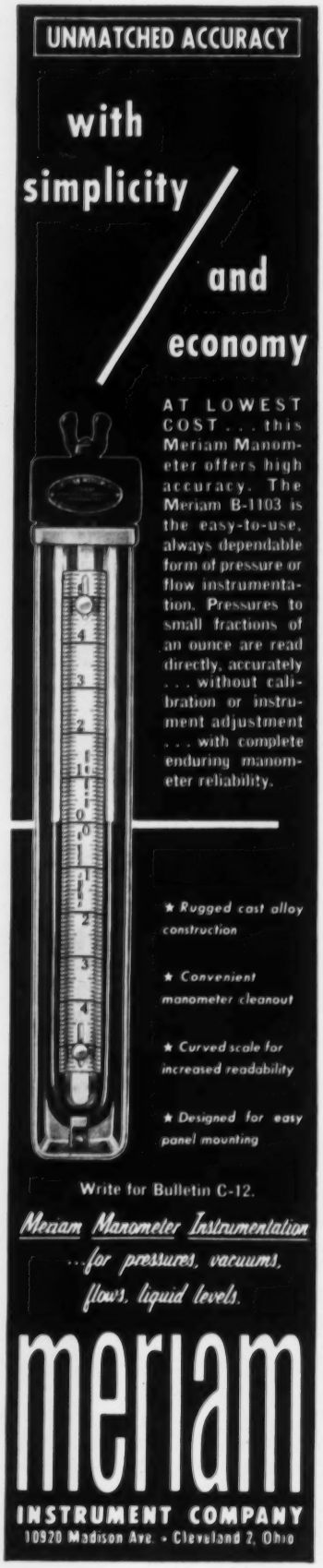
. . . reported to use up to 3 gph of water to put 574 lb of moisture into atmosphere every 24 hr—*Lake Erie Heating Corp., 138 W. Seventh St., Erie, Pa.*

Designed to increase, control humidity in paper and printing plants, tobacco warehouses, spinning plants, greenhouses, other places where moisture is factor.

Magnetic Level . . .

. . . for steam fitters, sheet metal workers, welders, mechanics, engineers, etc.—*Richards Merchandising, Inc., Dept. HPAC, 2424 Euclid Ave., Cleveland.*

Unit has built-in, permanent magnets designed to hold level on work without use of hands. Is said to hold securely on ferrous metals at any angle on flat, curved surfaces.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with simplicity and economy
AT LOWEST COST . . . this Meriam Manometer offers high accuracy. The Meriam B-1103 is the easy-to-use, always dependable form of pressure or flow instrumentation. Pressures to small fractions of an ounce are read directly, accurately . . . without calibration or instrument adjustment . . . with complete enduring manometer reliability.
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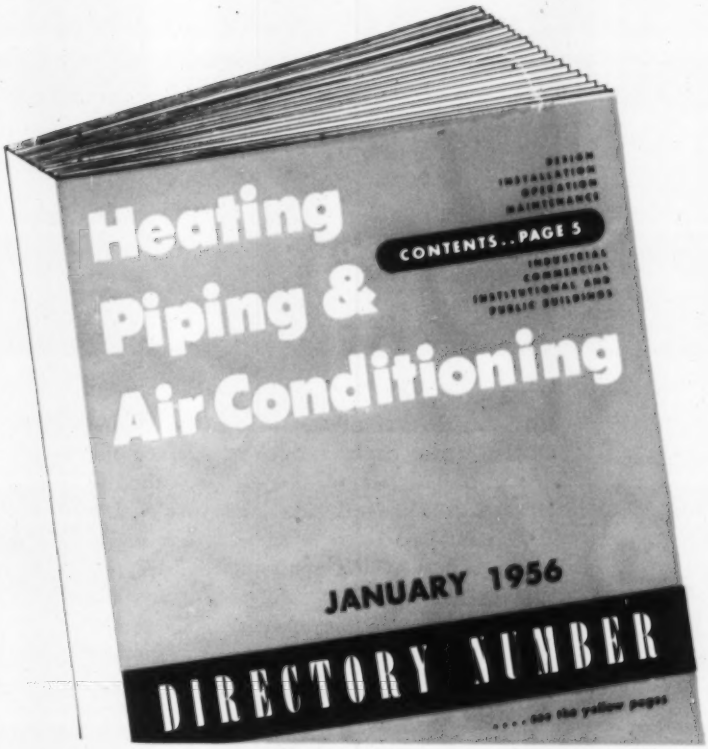

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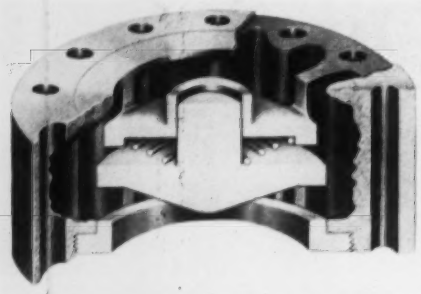


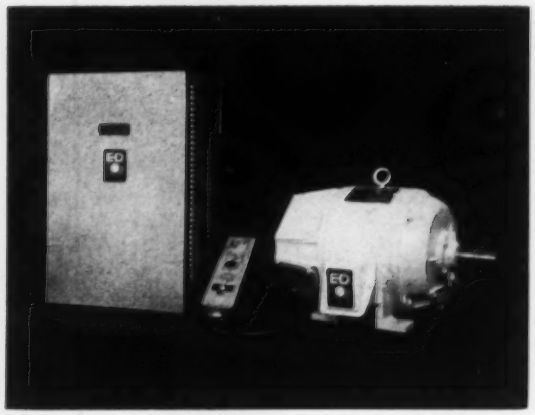
Flanged Silent Check Valve . . .

. . . for control of water hammer—*Williams Gauge Co., Inc., Dep. HPAC, 2 Gateway Center, Pittsburgh 22.*

Recommended by company for service—on water, oils, gasoline, chemicals, brine—where flow is constant. In sizes 4 to 10 in. For pressures 125 to 2500 psi. Cited features: removable and renewable disc and seat, wear resistant conical spring. Can be used in any position, says company.

Variable Speed Drive . . .

. . . engineered for wide speed range compactness, load compensating circuit for close speed regulation, ease of installation, stepless control, fast speed response, ease of maintenance—*Electro Dynamic Div., General Dynamics Corp., Dept. HPAC, Bayonne, N. J.*



Normal speed range is 22 to 1, but available in ranges to 60 to 1. With tachometer feedback, speed can be controlled to within ¼ of 1 percent, says company. Optional features include dynamic braking, reversing, inching control.

2-Way Flow Control Valve . . .

. . . adaptable to straight or angle installation—*Bell & Gossett Co., Dept. HPAC, Morton Grove, Ill.*

Designed to prevent gravity circulation in forced

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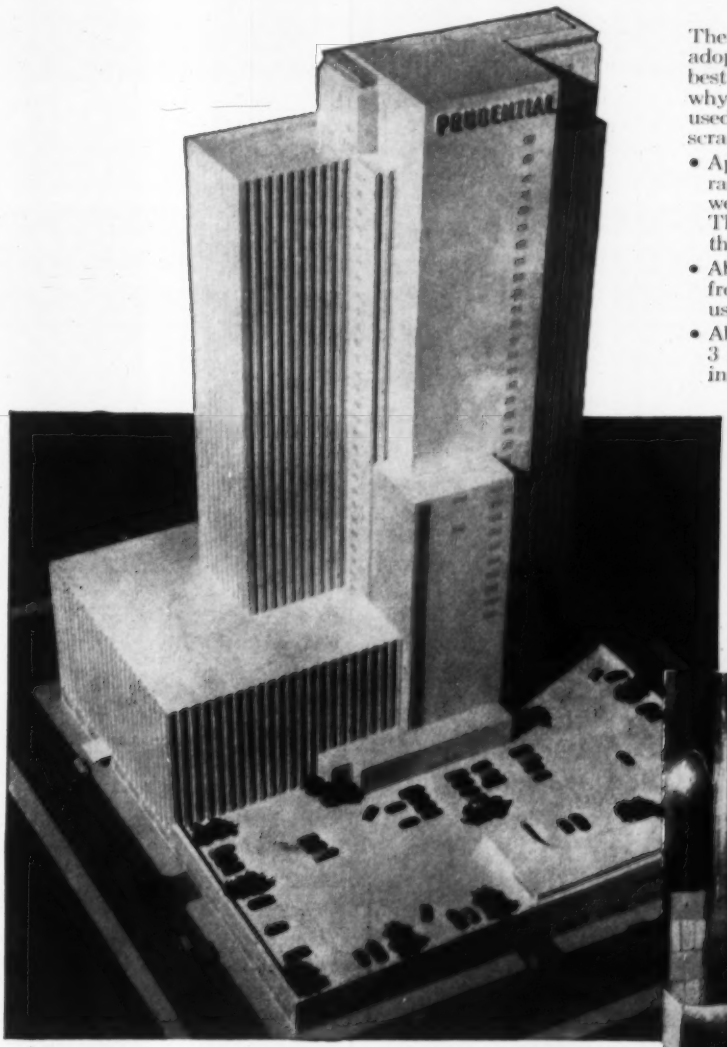
Prudential "takes out insurance" on safety and dependability with USS NATIONAL PIPE



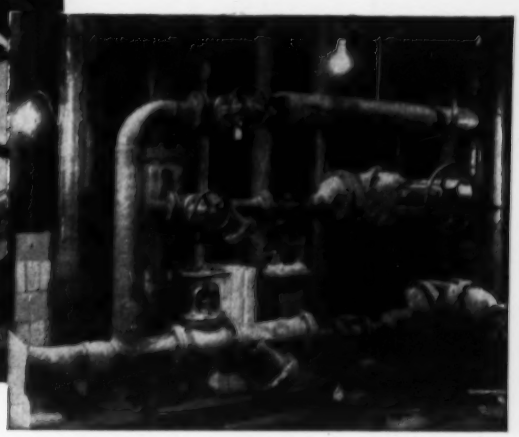
The new Prudential Building, Chicago, Illinois.

The Prudential Insurance Company of America adopted the policy of installing nothing but the best in their new Chicago office building. That's why almost 200 tons of National Steel Pipe were used in the construction of the ultra-modern skyscraper. Here's how the material was used:

- Approximately 120 tons of National Seamless, ranging in diameter from 6 inches to 20 inches, were employed as air conditioning carriers. These "risers" run from the sub-basement to the top floors.
- About 42 tons of National Seamless, ranging from 2 inches to 14 inches in diameter were used for heating and fan rooms.
- About 20 tons of National Pipe, from 1 inch to 3 inches in diameter, help make up the building's plumbing system.

It's no surprise that National Pipe is used in so many of the "big jobs" across the country. Engineers know from past experience that they can depend on National for safe, efficient, trouble-free service.

Write us for further information on the use of National Pipe in air conditioning, heating, and power installations. And, if you'd like some personal assistance with your pipe problems, get in touch with our engineers.



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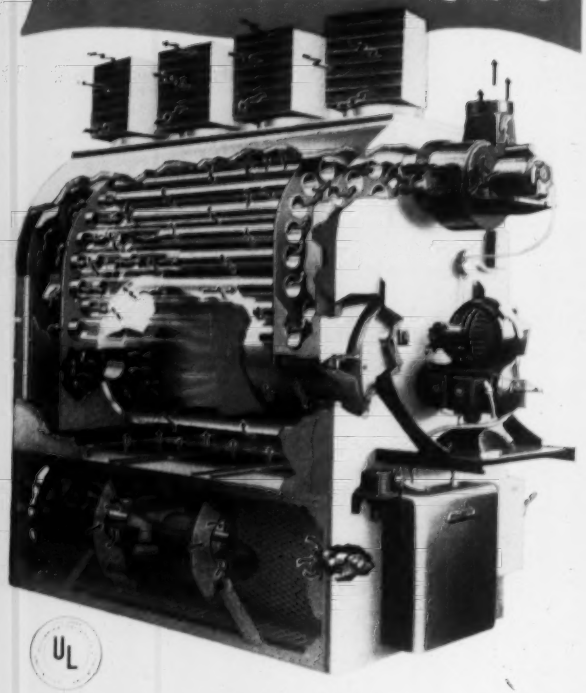

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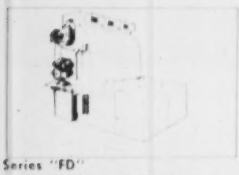
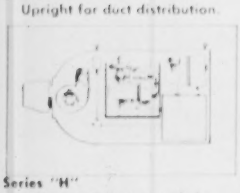


Series "FD"
Upright for duct distribution.



Series "H"
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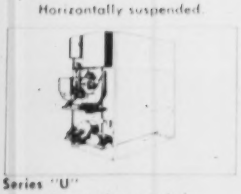

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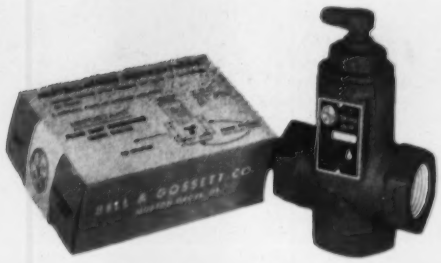

hot water heating system when booster pump not in operation. Available in 1, 1 1/4, 1 1/2 in. sizes. Replace individual straight or angle pattern valves of same size, says company.

Equipment Briefs . . .

ELECTRIC DEFROST EQUIPMENT with increase in horsepower to 1/3—*Drayer-Hanson, Inc., Dept. HPAC, 3301 Medford St., Los Angeles 63.* Previously 1/20 hp, change is part of company's standardization program in "Hot Shot" line.

FLUX POT designed to warm, maintain soldering, brazing flux at constant, efficient holding temperature—*Helmco, Inc., Dept. HPAC, 7400 W. Lawrence Ave., Chicago 31.* Is said to prevent underheating, overheating. In two sizes to hold 5 to 10 lb of flux. Operate on 110-120 volts, a-c; 175 or 350 watts.

PLASTIC EYESHIELD with "fogproof" design—*United States Safety Service Co., Dept. HPAC, 1215 McGee St., Kansas City 6, Mo.* Is result of method of integrally molding nickeled screen right into plastic frame to increase air circulation, reduce area of air traps, produce fog-free ventilation, company says.

PORTABLE EVAPORATIVE COOLER with 1200 cfm capacity—*Thermador Electrical Mfg. Co., Dept. HPAC, 5119 District Blvd., Los Angeles 22.* Will cool average sized room, says company. Diagonally balanced 12 in. four-blade fan driven by 1/25 hp motor. Plugs into 120 volt outlet.

POLYETHYLENE CAPS designed to protect threaded parts against dust, dirt, damage—*Clover Industries, Inc., Dept. HPAC, 523 Young St., Tonawanda, N.Y.* Serve as caps over external threads or as plugs to protect internal threads during assembly, shipment, storage. In sizes, styles to fit all threads, openings, says company.

There's something personal we put into the life of every motor we build

PICTURED above is one of A. O. Smith's skilled specialists who build integral hp and hermetic motors for heating, ventilating and air conditioning applications. Each of these men is proud of his work . . . proud that he is personally responsible for *complete* assembly of every motor he builds. This pride is an invisible part of every A. O. Smith electric motor . . . assuring tireless dependability to original manufacturers and ultimate users of powered equipment.

Today many manufacturers are installing A. O. Smith motors in evaporative condensers, blowers, refrigeration compressors, ventilators, unit heaters, etc. for commercial and industrial applications. They are sure of dependable performance because of the reasons described above . . . also because A. O. Smith motors are application-engineered to match particular product design. Remember! *Your special design is our standard.*

A. O. Smith builds motors in single and polyphase . . . in various speeds and frequencies . . . with low or high torque characteristics. These motors are backed by a national network of 270 strategically located factory service stations providing 24-hour service on all parts and service calls.

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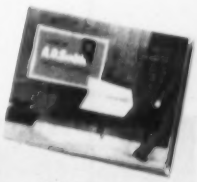

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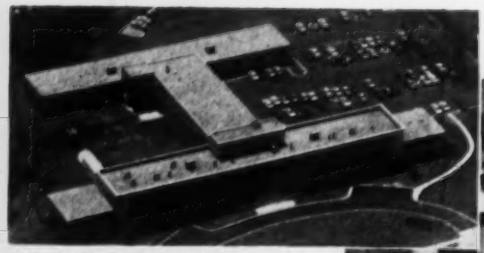
CORPORATION

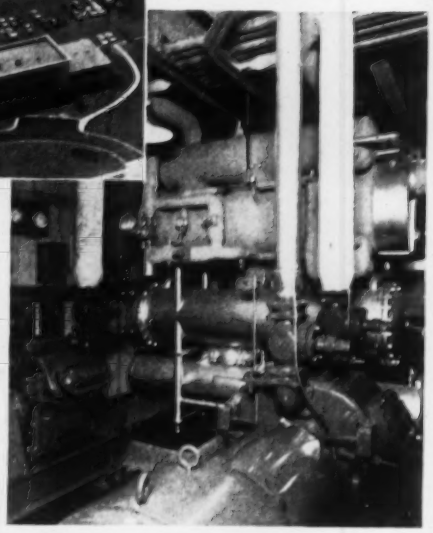
ELECTRIC MOTOR DIVISION

TIPP CITY, OHIO

International Division, Milwaukee 1, Wisconsin, U. S. A.



Midwest Research Institute, Kansas City, Missouri equipped with a Vilter central station air-conditioning system.



Two Vilter 6-cylinder VMC Freon-12 compressors, and a Vilter shell and tube cooler.

Q. *Why is Vilter Air Conditioning so well accepted in the Building Industry?*

A. because Vilter equipment lasts longer—and costs less to own*

Vilter performance starts with a soundly engineered system designed to your specific needs, careful installation, and on-the-job testing.

Note how carefully this Midwest Research Institute job was laid out: The installation consists of two Vilter 6-cylinder VMC Freon-12 compressors, direct-connected to two 60 hp, 1160 rpm motors. Each compressor has a capacity of 60 tons, making a total of 120 tons when cooling 360 gpm of chill water from 52° to 44°. The Vilter shell and tube flooded cooler is mounted on a stand in conjunction with the Freon condenser, liquid receiver, and heat exchanger. Each compressor is operated at ⅓, ⅔, or full capacity as the load requires . . . the system is completely automatic through the six-stage step controller . . . equipped with complete safety control system.

This system has operated entirely satisfactorily and the owners are well pleased. Call your Vilter representative about your problem.

Equipment furnished by O'Dower Engineering Co., Kansas City; Installed by A. D. Jacobson Plumbing and Heating Co., Kansas City; Designed by: Howarth, Scott and Kinney, mechanical engineers.

* Savings in low first cost are not the complete answer when considering the installation of refrigeration equipment. But savings in terms of years of extra service, reliable performance and minimum maintenance—that's where Vilter excels in low-cost ownership.

QUALITY CRAFTSMANSHIP that lasts . . .

ENGINEERING DESIGN that guarantees performance

Vilter®

REFRIGERATION and AIR CONDITIONING

THE VILTER MANUFACTURING COMPANY, Milwaukee 7, Wisconsin

Air Units • Ammonia & Freon Compressors • Booster Compressors • Baudelot Coolers • Water & Brine Coolers • Blast Freezers • Evaporative & Shell & Tube Condensers • Pipe Coils • Valves & Fittings • Pakice & Polarflake Ice Machines

EQUIPMENT DEVELOPMENTS

Continued

THERMOSTAT METAL for use in heating, ventilating industries—*American Silver Co., Dept. HPAC, 36-07 Prince St., Flushing 54, N.Y.* "Thermostat bimetal ASC-1" is said to have wide application in devices such as stacks, furnace controls, dampers, radiator valves, steam traps, room thermostats. Has deflection range —100 to 700 F.

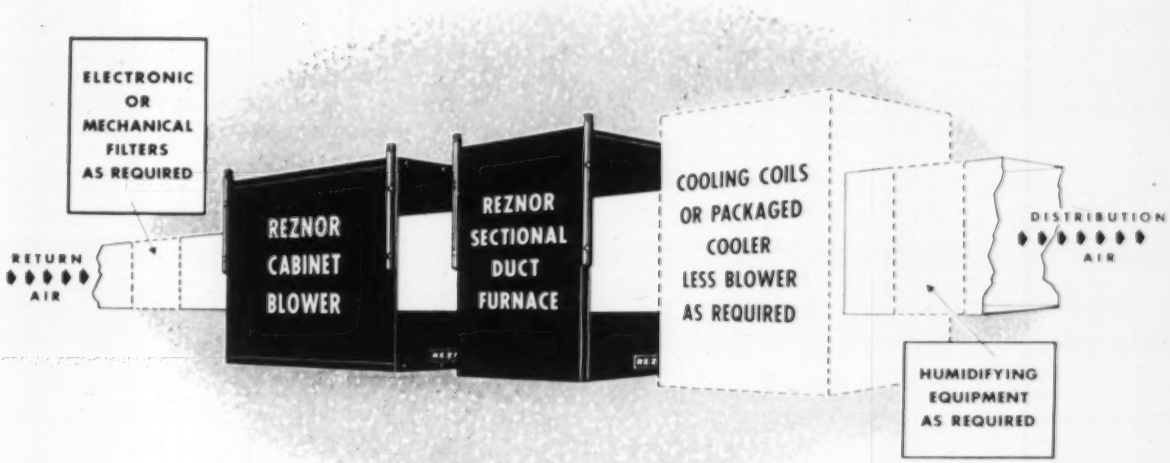
INDUSTRIAL FILTERS, DRIERS, other products added to company's line—*Mcluire Co., Dept. HPAC, Livingston, N.J.* Products include formed felt filter elements; dry air breathers for storage tanks; manual and automatic air, gas, liquid dehydrators for pressures to 4000 psi; water separators and filter assemblies for air, oil, water, chemicals.

ROOM AIR CONDITIONERS with built-in electronic filters—*Whirlpool-Seeger Corp., Dept. HPAC, St. Joseph, Mich.* Units also equipped with push button controls, heating element. Units in three models for rooms 385, 620, 830 sq ft.

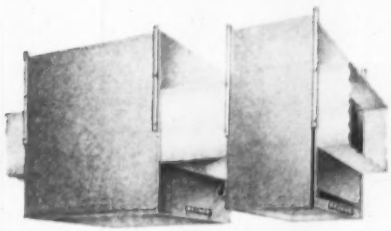
PIPE JOINT CEMENT formulated to provide lubrication as well as seal against leaks—*J. A. Sexauer Mfg. Co., Inc., Dept. HPAC, 2503-05 Third Ave., New York 51.* Cited features of "Stay-Tite" cement: does not harden in can; retains sealing qualities indefinitely to eliminate repeat repairs; remains in plastic state after application and can be removed without breakage.

ELECTRONIC AIR FILTER designed to remove smoke, dust, odors in offices—*Michael Electric Co., Inc., Dept. HPAC, 15 Stiles St., New Haven, Conn.* "Puritron" is size of average office inter-com unit. May be plugged into any electrical outlet. Is engineered to change air five times per hr, says company.

Here's the right start for a *custom-engineered* heating-cooling system


ELECTRONIC OR MECHANICAL FILTERS AS REQUIRED
RETURN AIR
REZNOR CABINET BLOWER
REZNOR SECTIONAL DUCT FURNACE
COOLING COILS OR PACKAGED COOLER LESS BLOWER AS REQUIRED
DISTRIBUTION AIR
HUMIDIFYING EQUIPMENT AS REQUIRED

You complete the picture by specifying additional components to meet *exact* job requirements



- Four sizes—air deliveries range from 1000 to 8000 CFM
- Built-in filter racks
- Removable panels allow easy access to filters and drive
- Standard height on all duct flanges, matches that on furnaces, facilitates duct connections
- Each blower is exact match for one furnace section, as required for heating only
- Larger blower with by-pass duct easy to install where addition of cooling equipment necessitates large air deliveries

- Four sizes—150,000, 200,000, 250,000 and 300,000 BTU
- Sections may be installed side-by-side and in multiple banks to achieve system capacities of more than 2,500,000 BTU
- Maximum section weight of 315 pounds eliminates installation problems on large capacity systems
- Threaded mounting tubes interchangeable for suspended installation or base mounting
- For use with any type of gas

- Interchangeable snap-out plates for vertical or horizontal flue connections
- Built-in draft diverter is reversible so that flue connection may face in either direction
- Controls may be located on end or side as preferred
- Designed for air flow in either direction
- Stainless steel or aluminized steel heat exchanger
- Rugged steel construction . . . grey-green Perlite baked enamel finish

THERE IS NO "EQUIVALENT" FOR REZNOR GAS HEATERS

REZNOR
THE WORLD'S LARGEST-SELLING GAS UNIT **HEATERS**

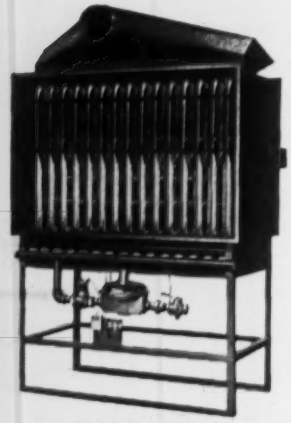
REZNOR MANUFACTURING CO., 51 Union Street, Mercer, Pa.
Please send me bulletins giving complete specification information on Reznor sectional duct furnaces and cabinet blowers.

NAME _____ TITLE _____

COMPANY _____

STREET _____

CITY _____ STATE _____

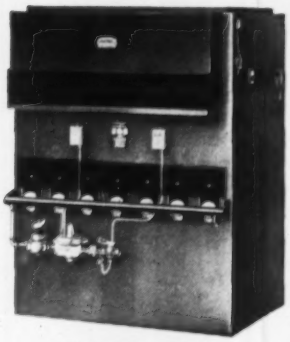


MODEL SED-E

MODEL SED-E — Non-corrosive type 321 stainless steel heat exchanger. Permits installation downstream of cooling equipment, for continuous blower operation. Air throughput in either direction. 80,000 to 600,000 Btu input.

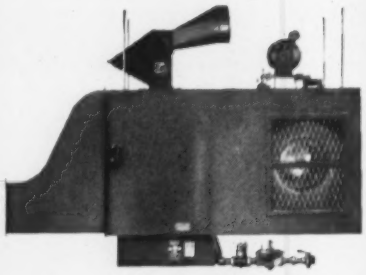
MODEL SED-S — Same as SED-E except controls are at the side, instead of at the end where accessibility requires either SED-E or SED-S is available in sizes from 80,000 to 600,000 Btu input in increments of 40,000 Btu.

MODEL SED-S



MODEL SED-VF

MODEL SED-VF — Tested and approved as a duct furnace; type 321 stainless steel. Re-circulated or fresh air enters through bottom, sides, or back. Built-in air bypass, vent in front. Sizes from 70,000 to 245,000 Btu input.



MODEL SEU

MODEL SEU — Suspended unit heater. Recirculates room air. Diffuser outlet with adjustable vertical and horizontal vanes. Double inlet forward curve blower. Continuous duty, variable pitch drives, raised port burners. 80,000 to 600,000 Btu input.

MODEL SEC

MODEL SEC — Forced air furnace. Stainless steel heat exchanger sections seam and arc welded. One piece cast iron burners with drilled ports. Oversize double inlet blower, glass or washable filters. 6 sizes — 70,000 to 245,000 Btu input. For zero clearance.

HAYES

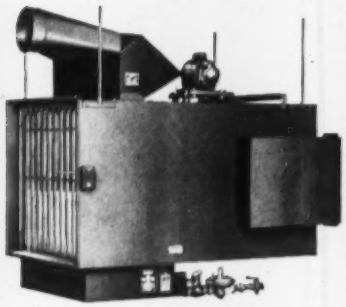
FURNACES

outstanding for commercial, industrial, schools, churches, theaters, large residential

HAYES FURNACE MFG. & SUPPLY CO.

3233 So. La Cienega Blvd., Los Angeles 16, California

Telephone TExas 0-3734



MODEL SES

MODEL SES—Forced air, suspended furnace for installation in suspended duct system. Inlet and outlet designed for sheet metal duct connection. Double inlet forward curved blower. Continuous duty variable pitch drives, raised port burners.

REPRESENTATIVES

M. Blazer & Son, Passaic, New Jersey.
Blue Flame Supply Company, Atlanta, Georgia
Eugene Bolstad, Edmonton, Alberta, Canada.
E. B. Bomar, Phoenix, Arizona.
Boyd Engineering Co., El Paso, Texas.
Reube O. Emery, Nashville, Tennessee.
F & D Distributors, Salt Lake City, Utah.
Leudecke Engineering Co., Austin, Texas.
McCombs Supply Co., Denver, Colorado.
O'Connor-Oklahoma Co., Oklahoma City, Tulsa, Oklahoma & Wichita, Kas.
Smith Steam Specialty Co., Kansas City, Mo.
Tay-Holbrook, Inc., San Francisco, California.
F. R. Young, Houston, Texas.
Dealers Supply Company, Atlanta, Georgia.
Jewell & Company, Hot Springs, Arkansas.
Nunn Electric Co., Lubbock, Texas.
Noland & Co., Newport News, Va.
Temp-Control Corp., Portland, Oregon

NEWS & COMMENTS . . .

Outlines Duties of Engineer and Contractor

. . . for better relationships

WHAT HAS BEEN done and what is being done to enhance the relationships between the engineer, the mechanical contractor and the owner in the Chicago area were reported on recently by Norman E. Bueter, consulting engineer. A summary of the views he expressed follows.

The engineer shall set forth in his plans and specifications a clear understanding of the nature of the construction work to be executed, and as far as possible clearly indicate the intent of such construction. To this end, his duties and responsibilities shall include the following:

1) He shall complete negotiations for all new incoming utilities and for changes in existing incoming utilities.

2) His plans and specifications shall be drawn to fulfill the requirements of city ordinances and state statutes.

3) He shall set forth in his specifications the extent of his knowledge of the facts wherein the structural arrangement or the inter-relationship of the mechanical trades set up problems that need consideration.

4) He shall be responsible for the full utilization of such parts of an existing mechanical system as is necessary — when such a system is remodeled or altered. Where it is necessary to make mechanical changes, he shall obtain information regarding existing mechanical systems and effect the necessary alterations of the existing systems. He shall assume full responsibility for such changes when the contractor is acting under his direction.

5) His plans and specifications shall be so written, whenever practicable, with respect to manufactured articles, such as pipes, ducts, conduits, switchboards, cables and other prefabricated items and materials so as to establish a competitive situation. Where a manufactured item is mentioned by name, provision shall be made, wherever practicable, for an alternate product.

6) His plans and specifications shall definitely locate all equipment and also indicate the sizes of pipes, ducts, conduits and other means for connecting such equipment.

7) His plans and specifications shall clearly indicate the type and extent of "shop drawings" to be prepared by the contractor.

8) He shall be responsible for the performance of the designed systems when such systems have been installed and adjusted in accordance with the plans and specifications.

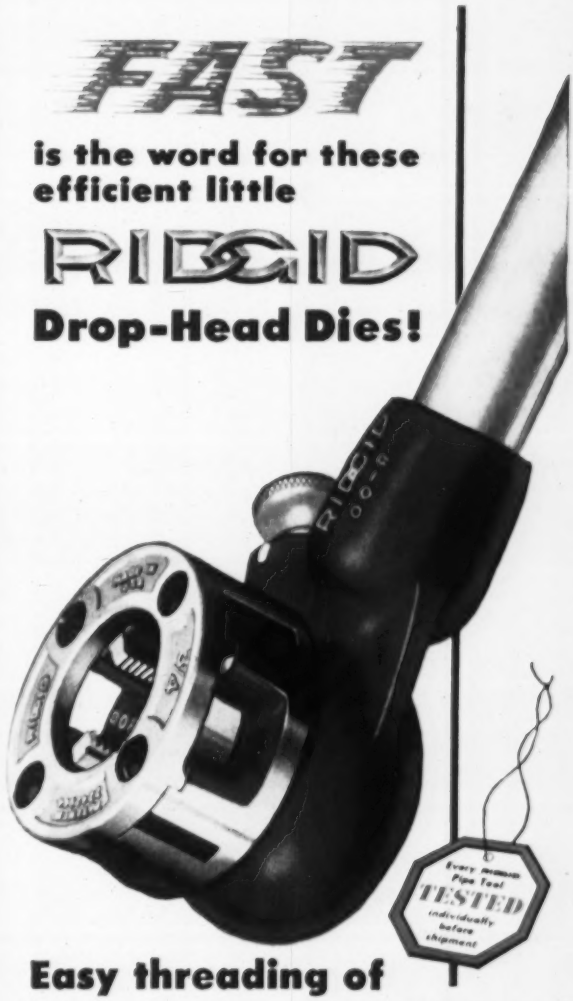
The contractor shall carry out the intent of the contract and shall meticulously follow the plans and speci-

FAST

is the word for these efficient little

RIDGID

Drop-Head Dies!



Easy threading of ⅛" to 2" pipe or conduit

Snap size head you want into ratchet drive ring, from either side—it can't fall out. Dies reverse easily for close-to-wall threading. 00R and 0R, ⅛" to 1"; 111R and 11R, ⅛" to 1¼"; 12R, ⅛" to 2". Free carrier with sets. Conduit and special dies available. Real work-savers—at your Supply House!

RIDGID *Bolt Threaders, too—No. 00R-B, ¼" to 1", National coarse and fine thread, efficient drop-head dies.*

"Threaded Pipe — *It's Tight — It's Best — Costs Less*"

RIDGID

Work-Saver Pipe Tools

The Ridge Tool Company, Elyria, Ohio, U. S. A.

Nunn Electric Co., Lubbock, Texas.
Noland & Co., Newport News, Va.
Temp-Control Corp., Portland, Oregon

NEWS & COMMENTS *Continued*

fications, unless he knows of the need for certain changes and calls these to the attention of the consulting engineer. To this end, his duties and responsibilities shall include the following:

1) He shall guarantee the installation against defective materials or workmanship for 12 months after acceptance of the completed installation.

2) He shall obtain approval from the engineer of all materials for use in completing the contract. He shall prepare and submit for approval detailed shop drawings for use in the field and for the coordination of his work with the work of other trades.

3) He shall conduct, through the engineer, all negotiations affecting the cost of installation, substitution of materials, delays in installation and other similar factors. No charge will be valid unless approved by the engineer.

4) He shall make the necessary adjustments and tests to place in proper operation the system which he constructed to conform with the plans and specifications — and which relate to his contract responsibility. He shall cooperate with the engineer and with the other trades where his activities interlock with their work.

While working for a large engineering corporation some years ago, said Mr. Bueter, "I made layouts for large projects, usually ignoring the structural and architectural features of the buildings. In other words, we would draw a line around the periphery of the building for the supply lines and show connections to the risers. This pipe would run through stairs, elevators and any other obstacle that was in its way. All that was necessary was pipe and valve sizes. Compare that with sizes, a trap schedule and radiator today's requirements.

"Today, we have many projects where the mechanical trades have contracts totalling over 50 percent of the total costs of the project. It is becoming more and more necessary for the owners to have a consulting mechanical engineer, and it is also essential for the engineer and the mechanical contractors to work together so that necessary cooperation and coordination may be accomplished."

The engineer and mechanical contractors are as important to the final completion and acceptance of any project as any other person or group, he concluded. ‡

Noise Control Doesn't Depend on Decibels

. . . other factors important

EXPERIENCE WITH DECIBEL METERS has proven that the measurement of decibels is not a good indicator of the effect of noise on the human ear, according to R. A. Gonzalez, director of application engineering, Airtemp Div., Chrysler Corp., in a recent data sheet published by his division.

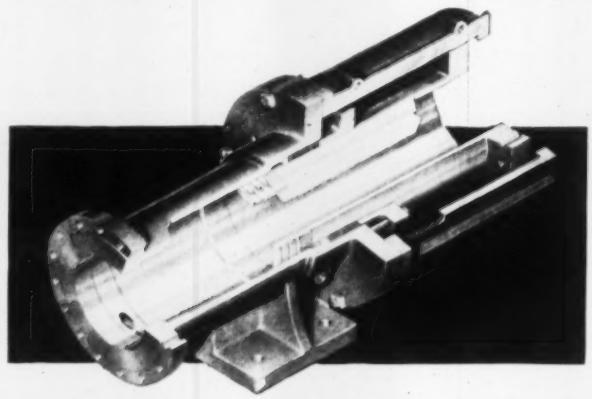
Sound, he reminds us, is a form of energy that moves through the air or other elastic mediums as a wave motion. Actually successive pressure variations, they impinge on the eardrums and cause the sound sensations which the human mind receives.

Sound waves have three physical

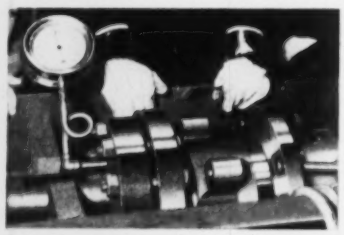
ADSCO

PISTON-RING EXPANSION JOINTS

can be unpacked at full operating pressure



PROOF FROM THE PITTSBURGH TESTING LABORATORY



All packing has been removed. There is no trace of steam in the empty stuffing box, even though steam in the line is at 240 lbs. with 700 F total temperature.

● For simple maintenance, a new ring of packing can be added to an ADSCO Piston-Ring Slip-Type Expansion Joint, but when the old packing has been allowed to become scored, it should be removed and replaced with fresh packing. The ADSCO Piston-Ring Joint is the only joint in the world in which this can be accomplished without shutting off line pressure. With the vent valve open, piston rings hold the line pressure while the joint is being serviced as in photograph at left.

Other features: The slip is continuously guided at its extreme ends throughout its entire length of travel. Primary and secondary limit stops prevent the slip from being pulled out of the body. Openings in the external guide provide easy access to the packing gland for adjustment. The external guide is built in halves to reduce the size of manholes required in underground construction.

These ADSCO Piston-Ring Joints are available in both single and double types, in full range of sizes, with 4", 8", and 12" traverse per slip, and for temperatures to 800 F and higher.

● *Write for Bulletin 56-20.*

AMERICAN DISTRICT STEAM DIVISION
ADSCO INDUSTRIES, INC.
20 MILBURN ST. BUFFALO 12, N. Y.

"You mean the air diffusers have been installed before you know how this floor will be divided?"

"Sure. We're using MULTIVENT. We can put partitions anywhere we want . . . now, or in the future . . ."

You're free to locate partitioned office space wherever it's needed, when you work with Multi-Vent low velocity air diffusers.

Once installed flush in the ceiling, Multi-Vent air diffusing panels need not be moved, altered in any way, or even adjusted when partitions are put in place—or when they're relocated.

Multi-Vent introduces conditioned air through the perforations in standard acoustical ceiling pans, at low velocity. The air is gently diffused downward into the room. There is no "throw" or "blow" to bounce off nearby partitions.

A partition may actually bisect a Multi-Vent panel, without affecting comfort conditions in the surrounding area. Ceiling symmetry is never a problem; Multi-Vent is completely concealed.

Write for detailed literature and name of representative in your area.

multi-vent

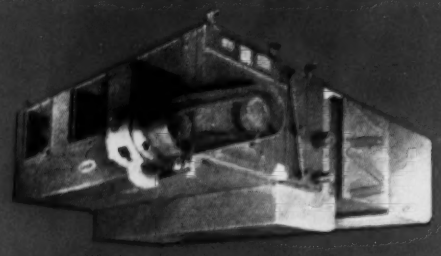
DIVISION OF THE PYLE-NATIONAL COMPANY

1373 N. Kostner Avenue, Chicago 51, Illinois

WHERE QUALITY IS TRADITIONAL

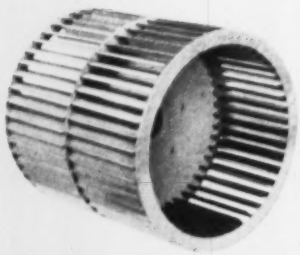
SALES AND ENGINEERING REPRESENTATIVES IN PRINCIPAL CITIES OF THE UNITED STATES AND CANADA

Carrier Heating and Ventilating Units...



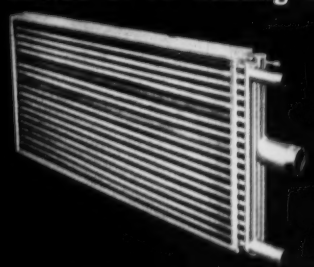
for civic, commercial and industrial buildings

now offer new Forward Curved fans...



for higher efficiency, quieter-than-ever operation

plus a choice of 72 heating coils!



six coil capacities in both distributing and U-bend coils for each casing size

New free 12-page catalog lists details, specifications, capacities.

CARRIER CORPORATION

305 S. Geddes St., Syracuse, New York

Carrier

I want to know more about the improved Carrier Heating and Ventilating Units. Please send me the new catalog.

Name

Firm

Address

City Zone State

properties: frequency, intensity, and velocity. The frequency of a sound wave is determined by the character of its source and is the number of complete cycles of compression and rarefaction which occur in a second. Sound intensity is defined as the rate of flow of sound energy per unit area. The velocity of sound changes with the density and other conditions of the transmitting medium. The practical purpose of velocity of sound traveling through the air may be taken as 1100 fps.

The decibel meter, says Mr. Gonzalez, is primarily a measurement of the energy of sound. It does not differentiate between the other qualities of the sound which are so important in their effect on the human ear. It has been repeatedly proven in laboratory tests that the decibel meter is not a reliable index of the existence a sound result that is undesirable and or the absence of "noise." In this instance, "noise" may be defined as unacceptable to the human ear.

A sound level measurement, he points out, depends in part on the amount of energy being released by the equipment (in the form of sound waves) and in part on the amount of sound energy that is being reflected and refracted from the surrounding walls, floor and ceiling. Therefore, the same piece of equipment tested in different conditions will give different readings. Also, two different samples of the same product can — and frequently do — produce materially different decibel readings due to slight internal differences.

Good sound level control, he suggests, depends upon the nature of the structure and upon installation arrangements of the equipment. Both the acoustical value of the spaces to be air conditioned and the sound level of the normal occupancy of those spaces must be judged. Good acoustical arrangements and high levels of occupancy noise require the minimum acoustical treatment of air conditioning supply outlets and return-air intakes.

Arrangements for theatres, churches and mortuary chapels frequently present problems due to the large size of equipment.

Air Sanitization Required With Air Conditioning in Florida

. . . provisions of law listed

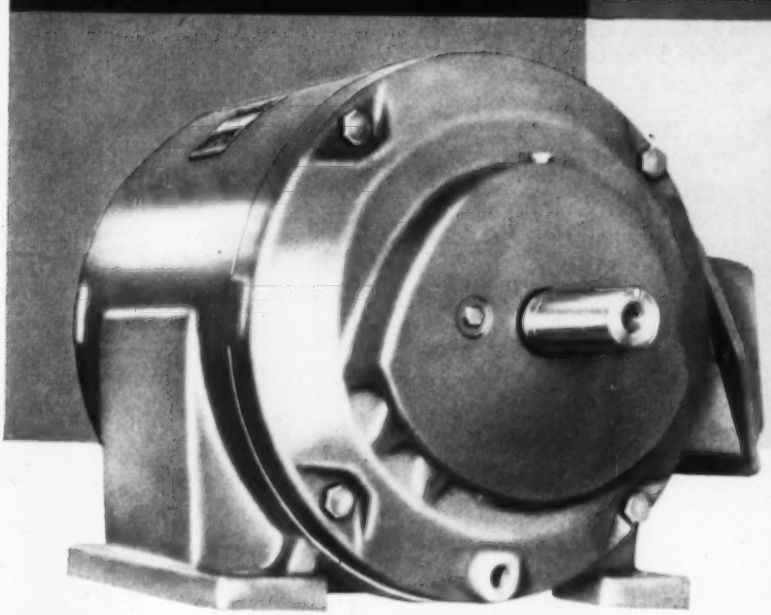
Air conditioning in hotels and restaurants in Florida must include air sanitizing equipment, under a state law. The law prohibits:

a) recirculation of air from any toilet, bath room, or kitchen of restaurants or other places where food is prepared for the public;

b) the use of corridors, halls, etc., for a return air plenum;

c) the use of recirculated air into bed rooms or private suites or apartments from any outside space, except under these conditions:

Totally Protected



FROM CORE TO COVER

RELIANCE *Totally-Protected* MOTORS

The total protection concept of design and construction armors Reliance A-c. Motors against everyday hazards, with little or no maintenance. Total protection is made up of extra features like:

Slot cell insulation of Double Backed Mylar

Dynamically balanced rotor for vibrationless operation

Entire insulation system impervious to acids, moisture and oils

Metering plate regulates grease flow to bearing

Ventilation louvres positioned high and dry in end brackets

There are 100 of these extra core to cover protection features in Reliance Motors. Each point is covered in our bulletin, "Check the Facts". Why don't you write for one and get all the details?

B-2510

RELIANCE ELECTRIC AND ENGINEERING CO.

Cleveland 10, Ohio • Offices in Principal Cities

Canadian Division: Welland, Ontario

Which of these
NEW PETROMETER
Liquid Depth Gauges

best suits your installation?

You can obtain new Petrometer Series 1400 Remote Reading Tank Gauges in 4 Models to suit almost every industrial installation. All gauges operate on the sound principle of hydrostatic pressure . . . no moving parts or intricate mechanisms to cause failure through wear, corrosion or friction. Large, vertical scale gives accurate, easy-to-see readings.

Gauges can be installed on tanks above or below the ground and up to ¼ of a mile away.

CHOOSE FROM THESE 4 MODELS

MODEL 1400 A

Equipped with aerating valve for semi-automatic purging of the transmission line. Purging line attaches to compressed air line.

MODEL 1400 B

Equipped with Bubbler as well as aerating valve. Transparent Bubbler provides a constant visual check on aeration. Used with compressed air source.

MODEL 1400 F

Equipped with Flowmeter and aerating valve. Actual rate of flow of air for purging can be preset and indicated on the Flowmeter. Requires compressed air supply.

MODEL 1400 M

For use where compressed air source is unavailable. Equipped with Manual Air Compressor and Aerating Valve.

Petrometer Gauges can be obtained in multiple units incorporated on a single panel and mounting plate to meet your specifications. High-level — low-level alarms also available.

For complete information, send for Bulletin 6004.

Petrometer CORPORATION

43-22 TENTH STREET, LONG ISLAND CITY 1, N.Y.

NEWS & COMMENTS

Continued

1. That air be sterilized by an approved method, such as chemical vapors or filters, electric radiation, etc.,

2. That odors be removed by activated carbon filters or chemical vapors or other approved methods,

3. That the plans and specifications for the installation indicate the percentage and volume of air to be recirculated and show the type of sterilizing and filtering to be used.

Evidence shall be submitted of the satisfactory use of such system for a period of at least two years with some form of testimonial as to its efficiency, or written approval by the Florida State Board of Health.

Existing buildings, equipped with air conditioning, may be brought into compliance by any of the above listed sterilization methods or any other approved method.

The code, whose local applicability is accepted voluntarily, applies to one and two family and multiple dwellings. Coverage for commercial, industrial, institutional and other nonresidential building is expected next year, the chairman says. ✠

Reading and Writing Ranked with Slide Rule

. . . in importance for engineers

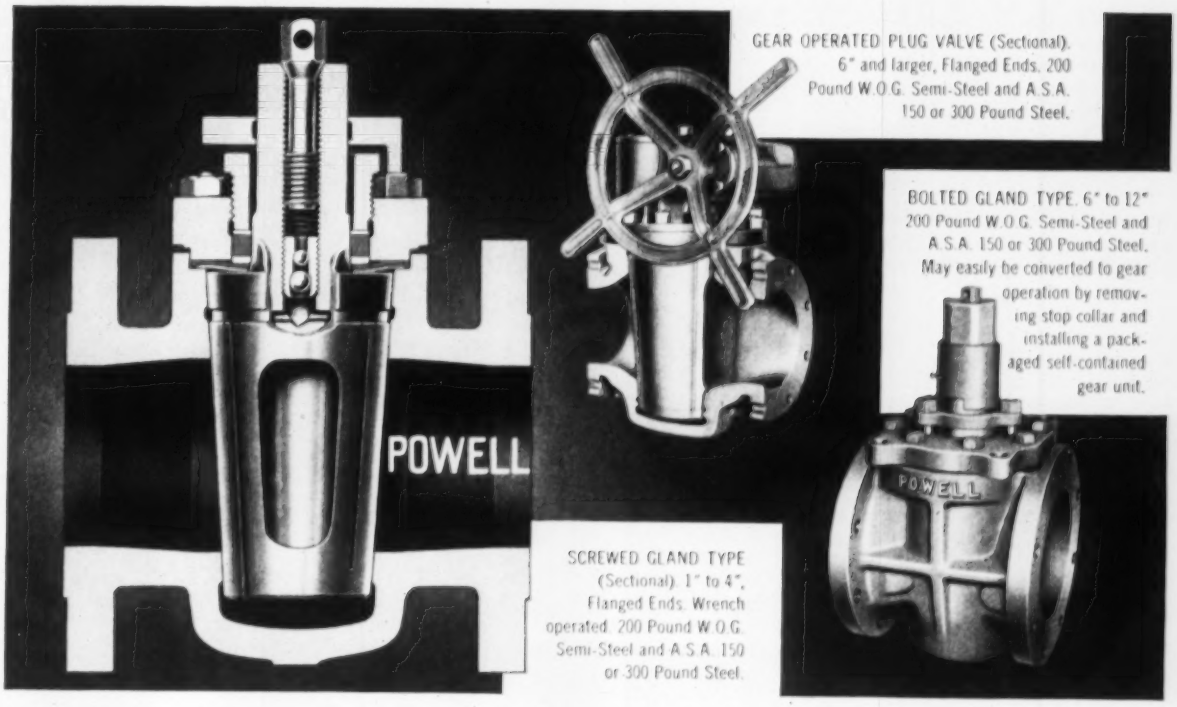
"To READ AND WRITE PROPERLY is as important as knowing how to manipulate a slide rule or understand complicated electronic formulas," declared C. L. Scheetz, training director of Minneapolis-Honeywell's Industrial Div., before 300 business education and commercial teachers in Philadelphia recently.

"Today, we still live primarily by dealing with words," he said. Yet top management people, he pointed out, poke along at 250 words a minute on such easy to read matter as newspapers. Engineers, he said, read even slower—about 208 words a minute—because of their tendency to analyze words as they go along.

As for writing, we are a nation of scrawlers, he said. This makes

POWELL

Lubricated Plug VALVES



GEAR OPERATED PLUG VALVE (Sectional). 6" and larger, Flanged Ends. 200 Pound W.O.G. Semi-Steel and A.S.A. 150 or 300 Pound Steel.

BOLTED GLAND TYPE. 6" to 12" 200 Pound W.O.G. Semi-Steel and A.S.A. 150 or 300 Pound Steel. May easily be converted to gear operation by removing stop collar and installing a packaged self-contained gear unit.

SCREWED GLAND TYPE (Sectional). 1" to 4". Flanged Ends. Wrench operated. 200 Pound W.O.G. Semi-Steel and A.S.A. 150 or 300 Pound Steel.

Powell Lubricated Plug Valves maintain our 110-year tradition of quality and precision. Only the finest available materials are used. And painstaking quality control is rigidly enforced through each and every step of manufacture.

Features include quick and positive operation—just a quarter-turn to open or close. Lubricant grooves surrounding each port provide a positive seal when the valve is closed. In an open position, seating surfaces are not exposed.

Valve users who want one source of supply for lubricated plug as well as all types of bronze, iron, steel and corrosion-resistant valves will want full details on Powell Lubricated Plug Valves.

Available in Steel and Semi-Steel through distributors in principal cities. If none is located near you—or if you need help on valve problems—write direct to

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BRONZE, IRON, STEEL AND CORROSION-RESISTANT VALVES

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The source of supply for all valve needs!

BETTER FLOW

WITH LOWER PRESSURE DROP!

Boost the Efficiency of Your Installations with

JE "floating" diaphragm
SOLENOID VALVES

Here's a fast, easy way to improve fluid flow . . . install a J-E "Floating" Diaphragm Solenoid Valve. This free-floating diaphragm gives less resistance . . . allows greater fluid flow with the same pressure differential.

Another time-saving feature is J-E's improved manual stem. It simulates the magnetic action, opening the pilot port with no more than ¾ turn of the stem–eliminates mechanical strain.

All this, plus:

QUIET OPERATION . . . no mechanical linkage or impact action.

DEPENDABILITY . . . tight seating, yet no chance for jamming or clogging.

EASY MAINTENANCE . . . only two moving parts . . . cool-operating coils . . . one size coil and one plunger fit all valves.

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JACKES-EVANS MFG. CO.
Controls Division
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NEWS & COMMENTS

Continued

communication unnecessarily difficult and expensive.

Mr. Scheetz predicted increased emphasis on reading and writing. As a result of automation, he said, bosses and employees alike will have to take steps to improve these skills just to keep up with business changes. ✣

Power Is Seen Key To World Peace

. . . new sources held vital

EVENTUAL WORLD PEACE rests largely on the equitable distribution and maintenance of the supply of goods and services for the benefit of all men, Dr. C. C. Furnas, chancellor of the University of Buffalo, believes. Speaking on *Energy Sources of the Future* at a recent annual congress of American industry, sponsored by the National Association of Manufacturers, he pointed out that the expanding industrial pattern requires a rapidly increasing amount of energy. Dr. Furnas said, "The population of the world and of the U. S. will both increase by about threefold by the year 2050. Nothing is in sight which could possibly change this trend. Energy use in an industrial society increases more rapidly than population. When all factors are considered, it appears that a century hence the annual world energy demand will be at least 10 times, and possibly 100 times, what it is today."

Consideration of the U. S. position indicates that our fossil fuel — coal, oil and gas — production will begin to fall short of meeting needs in one to three decades, according to Dr. Furnas. "It is of paramount importance to being exploring new sources," he said.

"The principal weakness of the future position of the U. S. and of the world," he stated, "is lack of fundamental knowledge in the field of nuclear and solar energy. Vigorous basic research programs should be pursued now, so an adequate technology based on future scientific discoveries can probably be developed in time to meet the essential energy needs." ✣

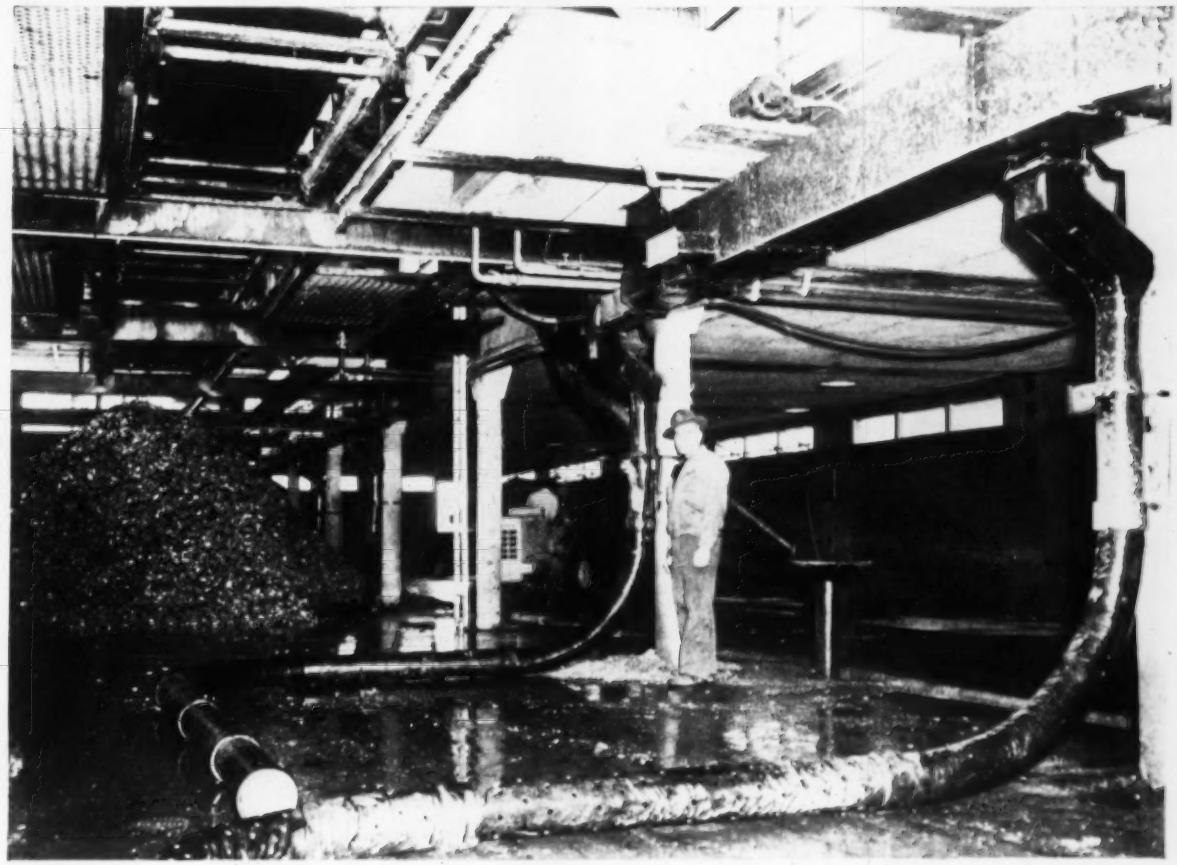
Schools Need More Adequate Facilities

. . . to keep pace

SERIOUS SHORTAGES of teachers and classrooms exist and the situation is getting worse, reports the National Association of Manufacturers. Educational facilities are not keeping pace with the growth in population or with the rise in national income.

Schools aren't getting enough money, and school construction is lagging behind needs. Furthermore, tax support is not increasing at a sufficiently rapid rate.

Enrollments in public elementary schools rose by almost 4.5 million in the past eight years, but in the next two years, a 2.4 million increase is expected. By 1958 the total may reach 26 million, or 1 million above the number now in school. ✣



HOW TO KEEP AN OYSTER COOL

The photo above illustrates a new and unusual use of air conditioning—believed to be the first application of its kind anywhere.

Oysters at the J. H. Miles and Company plant in Norfolk, Va., were formerly stored on ice overnight, still in their shells, until they could be shucked and packed the next day.

Now, however, they bask in luxurious air cooled comfort, thanks to a novel air conditioning system. As they are unloaded from the oyster boats, the bivalves are piled over perforated pipes on the storage room floor. Cold air is forced through the pipes and permeates the piles of oysters, keeping them cool and fresh until the next day's shucking. Cold air is also supplied into the space through grilles.

Two specially designed Marlo Ceiling Type Air Conditioning Units (top of photo) supply the cooling. Each unit has an air volume of 4000 CFM at 4" external static pressure. The units are arranged with stainless steel shaft and hot dipped galvanized casing, with 1" of waterproof insulation.

Baker & Co., Norfolk, was the air conditioning contractor on the project.

■ *For any air conditioning problem—unusual or otherwise—you'll find a solution in the comprehensive line of Marlo quality equipment. Write today for information and literature.*

MARLO coil co.

SAINT LOUIS 10, MISSOURI

Quality Air Conditioning and Heat Transfer Equipment Since 1925

The heart of the matter

IS IN THE COVERING

Available in standard pipe sizes and fittings in three thicknesses; Light, (Ice Water to 30° F.) Medium, (Brine and Ammonia to 0° F.) Heavy, (Heavy Brine—25° F. and lower.)

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THE IDEAL COLD LINE INSULATOR

Improper pipe insulation can mean an excessive loss in refrigeration efficiency and dollars to the cold storage operator. It is important to get the right pipe covering insulation that will have all these advantages:

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Retains over 80% of cold loss on piping
Easy and economical to install
Long trouble-free life
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RECENT TRADE LITERATURE . . .

▸ *ADHESIVES* — Data chart lists technical data, form, percentage solids, average viscosity, fastest optimum curing time, lowest optimum curing temperature, applications suggestions covering 30 adhesive formulations for bonding plastics, metals to themselves and to each other. *Rubber & Asbestos Corp., Dept. HPAC, 225 Belleville Ave., Bloomfield, N. J.*

▸ *ADHESIVES, COATINGS, SEALERS* — Properties, applications of variety of adhesives, coatings, sealers detailed in 12 page catalog. Tables show typical applications in various industries. *Minnesota Mining & Mfg. Co., Adhesives & Coatings Div., Dept. HPAC, 411 Piquette Ave., Detroit 2.*

▸ *AIR CONDITIONERS* — Form No. FA-1915 is 6 page folder describing, illustrating "Constellation," "De-Luxe" room air conditioners, including units for casement window installation. Specifications given for units in line. *Fresh'nd-aire Co., Div. of Cory Corp., Dept. HPAC, 221 N. La Salle St., Chicago 1.*

▸ *AIR CONDITIONING* — Wholesaler's catalog illustrates, describes over 100,000 items for dealers in air conditioning and refrigeration including electric motors, parts, supplies. *Harry Alter Co., Dept. HPAC, 1728 S. Michigan Ave., Chicago.*

▸ *BASEBOARD RADIATION* — New 12 page catalog covers company's "Custom" and "Pre-Fab" baseboard radiation. Includes capacities, ratings, specifications, dimensions, engineering data on both lines. *Rittling Corp., Dept. HPAC, Buffalo 5.*

▸ *BOILER FEEDWATER TREATMENT* — Technical reprint T-147 discusses hot process-hot zeolite boiler feedwater treatment. Presented as case history, literature discusses how chemical plant met its expanding

Dust, Dirt—and Maintenance HEADACHES Removed by Roll-O-MATIC

AAF AIR FILTER REQUIRES ONLY ONCE-A-YEAR SERVICING

THE filter curtains of this two-section ROLL-O-MATIC were once as white as the paper held in the man's hand. Now, note the gradation of color from light gray to black on the curtains' surface. When the accumulated dust load increases operating resistance to a predetermined level, ROLL-O-MATIC takes matters into its own hands—introduces automatically just the right amount of clean media from the rolls at top, while the dust laden media is re-rolled at the bottom.

No one has to guess when or how much clean media is needed. No bells clang or red lights flash to summon a maintenance crew. The ROLL-O-MATIC "just keeps rolling along" cleaning the air and itself automatically.

A 65 ft. length of ROLL-O-MAT media compresses into a compact roll only 15" in diameter. Under normal operating conditions, a single roll represents a *full year's supply* of clean air for a ROLL-O-MATIC section up to 11 ft. high (18000 cfm). Its cost—just half that of disposable filters of equal capacity. Its savings—countless maintenance man-hours plus the "worrying time" of management.

For complete information on this proven renewable media air filter, call your local AAF representative or write for ROLL-O-MATIC Bulletin 248.

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- *Construction*
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KENNEDY Low Pressure valves are manufactured of the same high quality bronze used in Kennedy 125 lb. valves. New, modern design for maximum strength with light weight; extra rigidity prevents distortion of the body when valve is being seated.

Each valve part is inspected seven times; each valve is subject to 300 lb. hydrostatic test; each low-pressure valve gets the same inspection as 125-300 lb. valve.

Easy installation of Kennedy Low-Pressure valves saves installation time, resulting in true economy.

These outstanding developments are what make Kennedy Low-Pressure Valves the Quality line.

Fig. 1
Designed for installation in steam and water lines where working conditions are not especially severe.

Fig. 1SJ
For low pressure steam and 150 lb. water services at temperatures up to 250° F. (when joints are made up with ordinary solder.)

Fig. 87
Made from the same quality materials as Kennedy Standard Valves, but for lower pressure services.

Fig. 104
For general service which is not severe. Swing disc on hinge is fitted with a stop to prevent sticking in the open position.

Fig. 5
For systems which require shut-off valves, where working conditions are not severe.

Fig. 9
For use on hot water radiator heating systems especially designed for ease of operation (open or close in one-quarter turn.)

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RECENT TRADE LITERATURE

Continued

needs with new water treatment plant. *Graver Water Conditioning Co., Dept. HPAC, 216 W. 14th St., New York 11.*

▸ *CENTRAL HEATING* — *Central Heating for Brooder Houses with Automatic Coal Feeding* is reprint of article describing application of automatic coal equipment to central heating systems in a brooder farm. *Anthracite Information Bureau, Dept. HPAC, 342 Madison Ave., New York 17.*

▸ *CENTRIFUGAL FAN VENTILATOR* — Low design centrifugal fan unit designed to exhaust ventilation ducts serving relatively small spaces covered in form No. 304. Literature includes dimensional drawing, table of dimensions, table of sizes and capacities. *Swartwout Co., Dept. HPAC, 18511 Euclid Ave., Cleveland 12.*

▸ *CENTRIFUGAL PUMP* — Stainless steel centrifugal pump with pedestal mount described in bulletin PC 1155. Chemical resistance, construction features detailed. Performance data, cited mechanical advantages presented. *Eco Engineering Co., Dept. HPAC, 12 New York Ave., Newark.*

▸ *CLAY CONDUIT SYSTEMS* — New 20 page bulletin No. 56 describes various types of clay conduit systems for underground steam, hot water, process piping produced by company. Varying job installations presented graphically. *Heat Transmission Conduit Co., Dept. HPAC, 2300 Payne Ave., Cleveland 14.*

▸ *COOLING TOWERS* — Construction, operational details of new induced draft cooling tower described in bulletin CT-56-1. *Foster Wheeler Corp., Dept. HPAC, 165 Broadway, New York 6.*

▸ *COOLING TOWERS* — Bulletin 33-104-56 gives detailed information

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"In the mechanics of Air Distribution: the first requirement of the air outlet is to thoroughly mix the supply air with the room air outside of the zone of occupancy."

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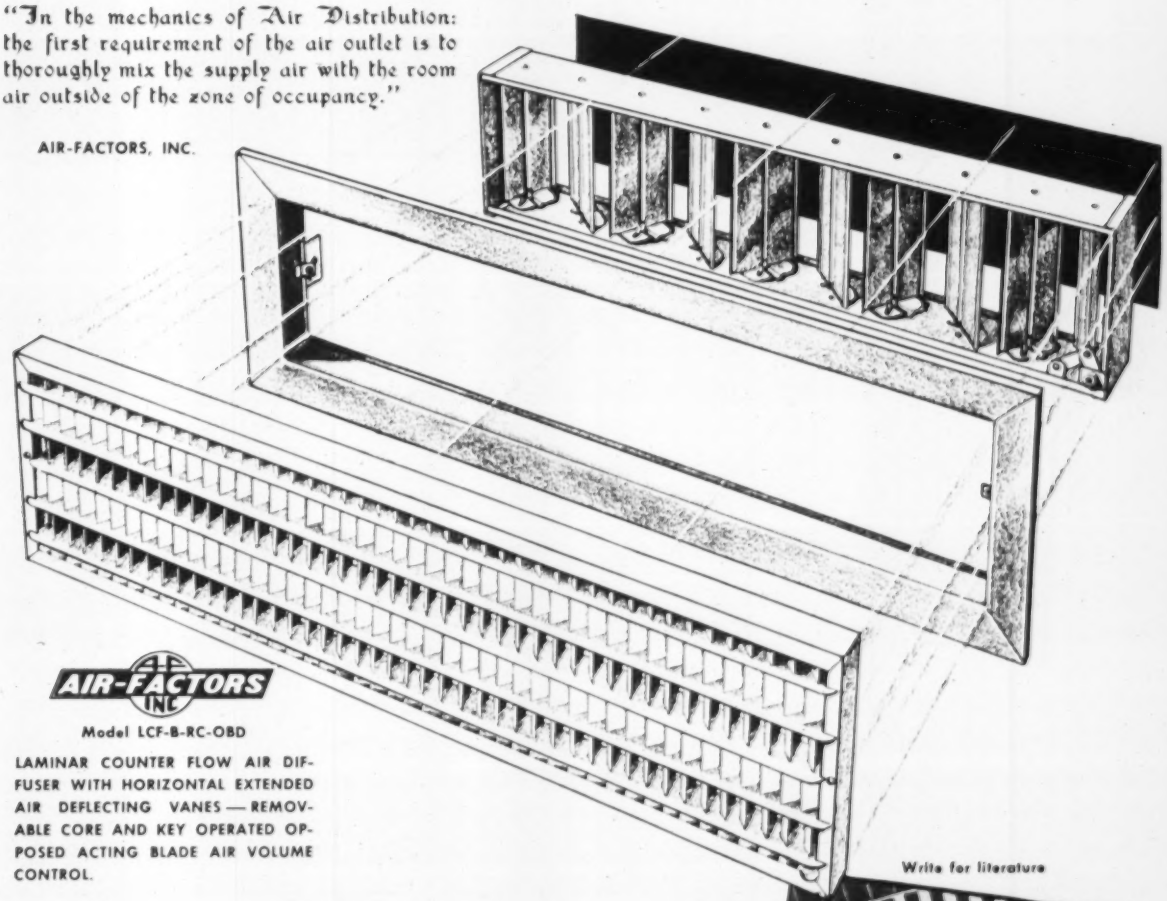

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SEE HOW TODAY'S KOOLSHADE®

DECORATES AS IT COOLS

By guarding windows against the sun's hot rays, KoolShade Sunscreen reduces cooling needs, saves air conditioning dollars. This benefit has been known for years.

But now comes proof of a new advantage. Today's KoolShade *decorates* as it cools! As installations like the one above show, buildings *look* better with KoolShade.

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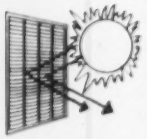
Engineer, contractor or owner-manager, it will pay you to investigate KoolShade. You'll feel and *see* the difference.

Only KoolShade gives you all this



- **unsurpassed shading efficiency** — keeps out up to 87% of the sun's hot rays; 100 sq. ft. of KoolShade cuts cooling load about one ton.
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- **virtually no maintenance** — specially-treated metal louvres won't corrode, never need painting.

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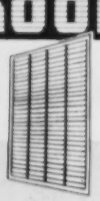

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ALFOL INSULATION

INGERSOLL ROOF DECK

RECENT TRADE LITERATURE

Continued

on company's 1956 line of cooling towers. Cited feature of line is new coating said to guard against rust, corrosion, salt air, corrosive atmosphere, abrasion, water treating chemicals. *Havens Cooling Towers, Div. of Havens Structural Steel Co., Dept. HPAC, 1713 Chrystal Ave., Kansas City 26, Mo.*

▶ *CORROSION PROOFING* — New brochure on corrosion proofing materials, techniques contains information on cement mortars, interliners for masonry construction, protective coatings and linings for surface treatment. *Pennsylvania Salt Mfg. Co., Dept. HPAC, 3 Penn Center Plaza, Philadelphia 2.*

▶ *DEALKALIZATION OF WATER* — Technical reprint T-142 covers details of dealkalization as a method of aklalinity reduction. Details of process limitations and where it can be used discussed. *Graver Water Conditioning Co., Dept. HPAC, 216 W. 14th St., New York 11.*

▶ *DEHUMIDIFICATION* — *Dehumidified Storage With Particular Emphasis on Preservation of Materials Within Metal Hutments* is title of bulletin DS-1. *Desomatic Products, Inc., Dept. HPAC, Falls Church, Va.*

▶ *DIFFUSERS* — Floor, ceiling, wall, baseboard diffusers covered in pocket sized folder. Smoke test photographs, details of induced aspirating effect of units included. *Lima Register Co., Dept. HPAC, Lima, Ohio.*

▶ *DUST COLLECTOR* — Packaged type "Aerodyne" dust collector described in bulletin 172-CFF. Literature contains illustrations, details of operation in its 4 pages. *Green Fuel Economizer Co., Inc., Dept. HPAC, Beacon, N. Y.*

▶ *DUST CONTROL* — Dust, fume control in various facets of metals

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RECENT TRADE LITERATURE

Continued

refining industry is subject of new bulletin, *No Air Pollution*. Typical examples of control presented by illustrated case histories. *Wheelabrator Corp., Dept. HPAC, 1321 S. Byrkit St., Mishawaka, Ind.*

▸ *ELECTRIC THERMOSTATS* — Revised bulletin No. 1000B describes electric room thermostats for factories, institutions. Also featured are immersion thermostats for hot water heating systems, unit heaters and alarm circuits and surface thermostats for low limit control on unit heaters. *Sarco Co., Inc., Dept. HPAC, Empire State Bldg., New York 1.*

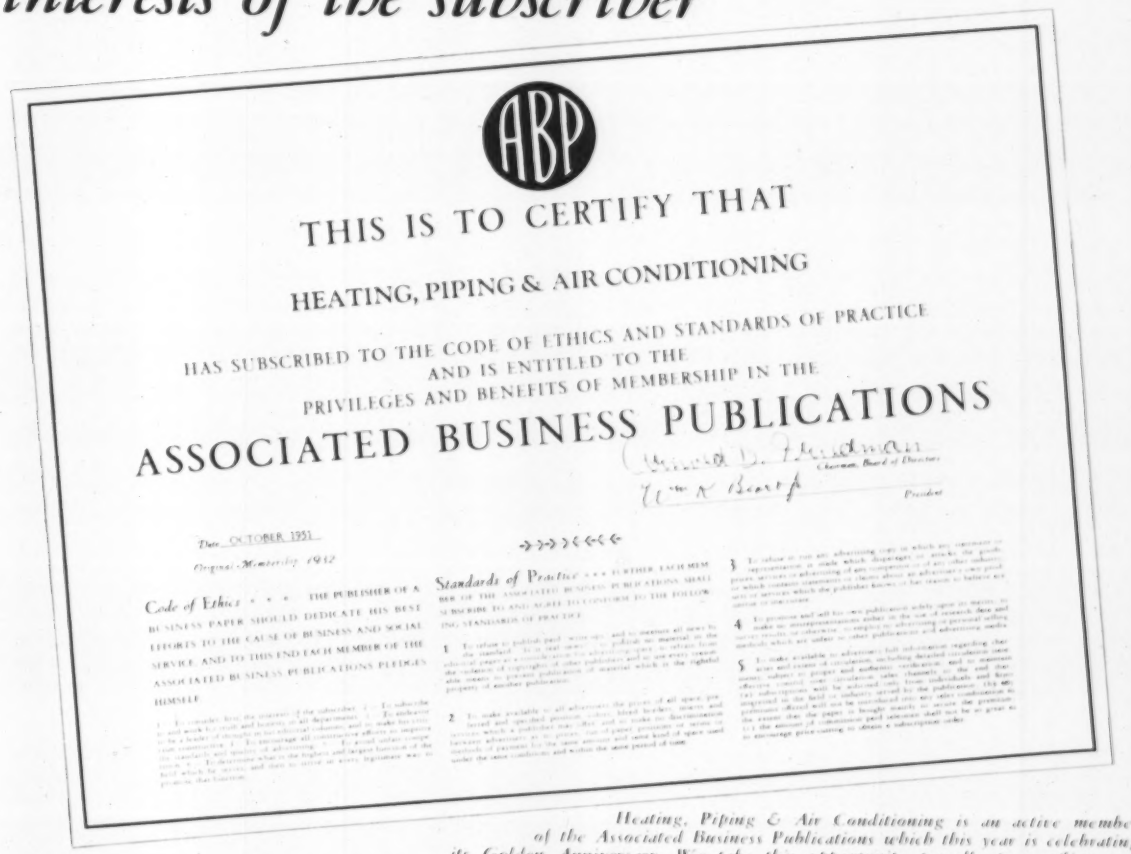
▸ *EXPANSION JOINTS* — New 24 page catalog No. 153 is expansion joint design guide including discussion of various types of expansion joints on market. Engineering, application, selection data necessary to proper solution of pipeline expansion problems provided, says company. *Flexonics Corp., Dept. HPAC, 1391 S. Third Ave., Maywood, Ill.*

▸ *FANS* — Bulletin describes "Galex Airfoil" type draft fans designed to fill severe draft requirements of today's power plant operations. Wheel diameters range 30 to 98 in. in each of six different designs. *Green Fuel Economizer Co., Inc., Dept. HPAC, Beacon, N. Y.*

▸ *FITTINGS* — New 4-page bulletin, "Jaco the Zytel Miracle Fitting," describes company's development of a lightweight nylon fitting said to be impervious to most acids and alkalies, and designed not to crack or leak under normal conditions. *Jaco Mfg. Co., Dept. HPAC, Box 2659, Cleveland.*

▸ *FLEXIBLE DUCTING* — Bulletin 12-EB-2 gives engineering information on "Thermaflex" laminated metal ducting designed for use as "run-outs" in both high and low pressure air conditioning systems. *Flexible*

"to consider FIRST the interests of the subscriber"



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RECENT TRADE LITERATURE

Continued

Tubing Corp., Dept. HPAC, Guilford, Conn.

▶ *FLOW VALVE* — Eight page booklet describes "Hydro-Lok" flow valve said to have ability to make positive seal under practically every condition. Can be made to withstand pressures to 15,000 psi, temperatures to 400 F or greater, says company. *American Flow Control, 2220 South Blvd., Houston.*

▶ *FLUXING PROCEDURES* — New manual is guide to selective fluxing for low temperature silver brazing. Can also be used for correct selection of flux based on specific temperature ranges, metals to be joined, says company. "Flux Selector Chart" is included. *American Platinum Works, Dept. HPAC, 231 New Jersey Railroad Ave., Newark 5.*

▶ *HEAT TREATMENT OF ALLOYS* — Twelve page pamphlet, *Heat Treatment of Air Hardening Alloys on Welding*, provides metallurgical data on postweld heat treatment, influence of weld preheating temperature on hardness and microstructure of heat treated welds of air hardening alloys. *Babcock & Wilcox Co., Dept. HPAC, Beaver Falls, Pa.*

▶ *HEATING, AIR CONDITIONING* — Twelve page catalog covers company's line of heating, air conditioning specialties. Several new products highlighted. Illustrations show venting, balancing of hot water heating, chilled water cooling systems. *Maid-O'-Mist, Inc., Dept. HPAC, 3217 N. Pulaski Rd., Chicago 41.*

▶ *HEATING CONTROLS* — Use of automatic time controls with oil burners, gas units, stokers described in 4 page bulletin NR-26. Standard timer applications listed together with type of time control required for each. *International Register Co., Dept. HPAC, 2620 W. Washington Blvd., Chicago 12.*

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Theater tickets *can be ordered in advance at low price.* TV and radio and fashion show tickets will be available as long as they last. Sight-seeing trips by water and land will be available too. Bring your wife to the OHI Ladies Lobby on the Mezzanine of the Park Sheraton for assistance on entertainment and where to go and what to see.

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SCHEDULE OF MEETINGS:

Mon., June 11: All OHI Meetings including the Annual Meeting, Board, Division and Committee meetings.

Tues., June 12: Domestic Equipment & Accessories Manufacturers' Conference and an Engineering-Technical Session.

Wed., June 13: Dealer Management Conferences and the Commercial-Industrial Symposium.

Thurs., June 14: Dealer Management Conference in the morning. Also the OHI Luncheon 12:45-3 P.M. to be held at the *Sheraton-Astor Hotel* at Times Square. Here annual awards are made and a nationally prominent person will be the guest speaker.

BIG DEALER INTEREST centers in Dealer Management Conferences. Many subjects are scheduled for panels and round tables such as home cooling, radio communication, automatic deliveries, telephone procedures, sales and advertising, service contracts. *Special attraction:* The new TV sound-color film will have its premiere—*first* for the industry. Also *first time showings* of new service-installation film strips. In addition, a well-known speaker.

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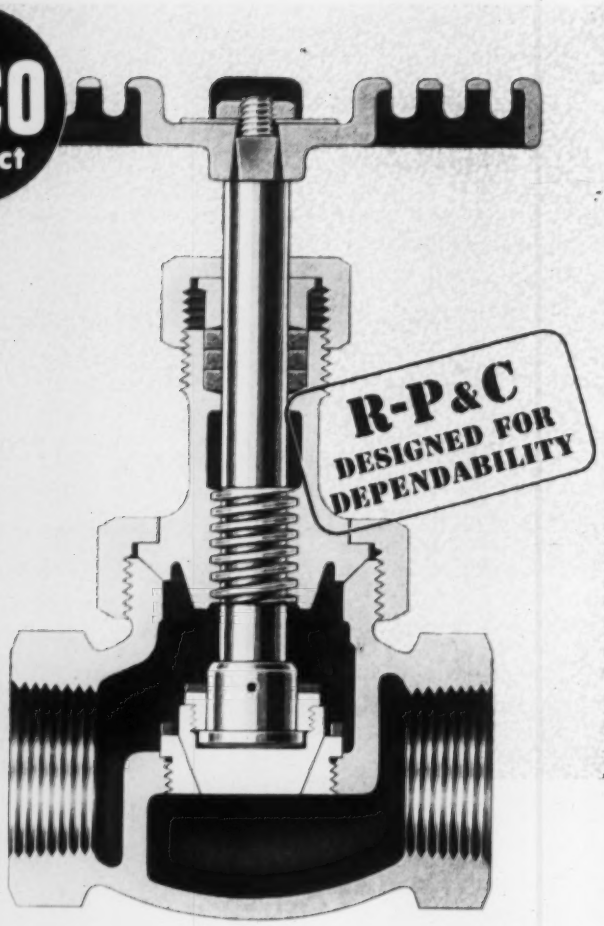

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R-P&C's new **Fig. 427-DP** bronze globe valve is recommended for steam, water, oil and gas service where control or regulation of flow is required. Its 500 Brinell stainless steel seat and disc resist wire-drawing—make it particularly suitable for continuous throttling and other severe applications.

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RECENT TRADE LITERATURE

Continued

▸ *HUMIDITY RECORDERS* — Bulletin H1008 describes, illustrates portable recorders for relative humidity, temperature. Samples of typical records made by "Thermo-Humidigraph" shown. *Bristol Co., Dept. HPAC, Waterbury 20, Conn.*

▸ *INSTRUMENTS* — Catalog bulletins Nos. 3001 and A-103 cover line of instruments recommended by company for air conditioning and refrigeration wholesaler and service technician trade. Literature contains illustrations, specifications, information covering proper usage of units. *Simpson Electric Co., Dept. HPAC, 5200 W. Kinzie St., Chicago 44.*

▸ *MAGNETIC STARTERS* — Line of reversing, nonreversing line voltage a-c magnetic starters detailed in 8 page bulletin 1020. Construction, application, engineering specifications pertaining to various types included. *Essex Wire Corp., Dept. HPAC, 1601 Wall St., Ft. Wayne.*

▸ *MANOMETERS* — Four basic types of manometers set forth in 4 page bulletin No. G-10. Principles to aid in proper selection provided. Specialized manometer instruments also described for pressure, vacuum, flow, liquid level services. *Meriam Instrument Co., Dept. HPAC, 10965 Madison Ave., Cleveland 2.*

▸ *MECHANICAL TUBING* — Folder TB-362 tells how, in case histories, company's electric resistance welded carbon steel mechanical tubing solved engineering problems, simplified production, reduced cost, manufacturer reports. *Babcox & Wilcox Co., Dept. HPAC, Beaver Falls, Pa.*

▸ *"MIDGET" EVAPORATIVE CONDENSER* — Illustrated catalog sheet 31C5a describes evaporative condenser designed for low tonnage air conditioning applications. Units available in 2, 3, 4, 5 ton sizes. *Refrigeration Engineering, Inc., Dept.*

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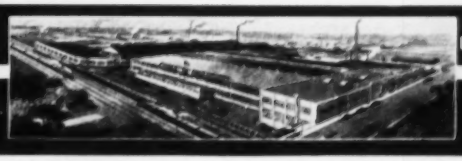

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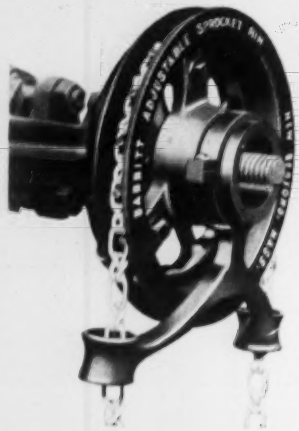

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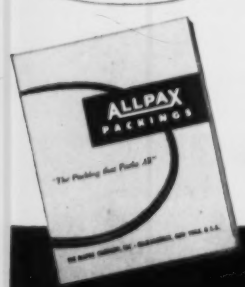

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RECENT TRADE LITERATURE

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HPAC, 7250 E. Slauson Ave., Los Angeles 22.

▶ *MOTOR OPERATED VALVE* — Bulletin F-6801 and control application data CA-12 cover motor operated valve designed for individual room temperature control for schools, offices, hospitals, apartments, hotels, motels, etc. *Barber-Colman Co., Dept. HPAC, Rockford, Ill.*

▶ *MOTORS* — Bulletin No. 1300 on rapid-reversing motors features cutaway view showing construction of blower-cooled, rapid-reversing motor said to be capable of more than 200 idle reversals per min. Engineering information given consists of formulas on inertia, motor reversal calculations. *Louis Allis Co., Dept. HPAC, Milwaukee 7.*

▶ *MOTORS* — Data, specifications for company's line of motors detailed in form 943. Information includes ratings, prices, other pertinent data. *Century Electric Co., Dept. HPAC, 1806 Pine St., St. Louis 3.*

▶ *NAME PLATES* — Catalog 56T describes line of name plates designed to identify and label air conditioning installations, equipment. Literature illustrates plates available, lists prices. *Seton Name Plate Co., Dept. HPAC, 394 Central Ave., New Haven 15, Conn.*

▶ *NEEDLE VALVES* — New 4 page bulletin on bar stock needle valves contains dimensional data, flow curves, engineering features. *Hoke, Inc., Dept. HPAC, S. Dean St., Englewood, N. J.*

▶ *OIL BURNER ACCESSORIES* — Catalog O contains illustrations, specifications for company's line of oil burner accessories such as domestic nozzles, air cones and stabilizers, "anti-pulsating" equipment, combustion heads, valves and strainers, in-

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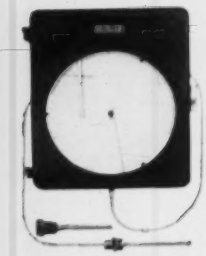

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RECENT TRADE LITERATURE

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dustrial nozzles. *Monarch Mfg. Works, Inc., Dept. HPAC, 2501 E. Ontario St., Philadelphia 34.*

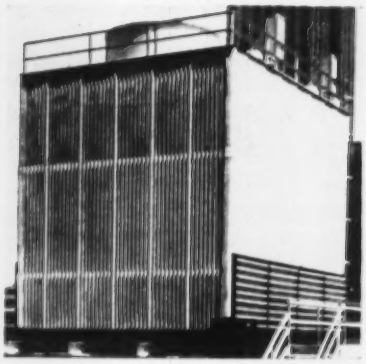
▸ *OXYGEN ANALYZER* — New 16 page catalog 55-829-56 explains principle, construction, operation, features of both paramagnetic type "Magno-Therm" analyzer and electronic recorder. Chart lists functions, services, how and why analyzer is used. *Hays Corp., Dept. HPAC, Michigan City, Ind.*

▸ *PIPE, FITTINGS, VALVES* — "Van-Cor" rigid unplasticized polyvinyl chloride pipe, fittings, valves covered in three bulletins. No. 1 describes chemically resistant pipe with normal impact strength. No. 2 details chemically resistant pipe with high impact strength. No. 3 is devoted to valves. *Colonial Plastics Mfg. Co., Dept. HPAC, 3007 Grand Ave., Cleveland.*

▸ *PIPE NIPPLES* — New 16 page catalog 755 contains specification tables, price lists for line of pipe nipples. Company's services to customers described. *Pittsburgh Nipple Works, Inc., Dept. HPAC, 1455 Spring Garden Ave., Pittsburgh 12.*

▸ *PIPE PUSHER* — Bulletin presents features of "Speed-Thru" continuous stroke pipe pusher designed for underground piping installation. Variety of uses listed. *Mercury Hydraulics Inc., Dept. HPAC, 2440 Blake St., Denver 5.*

▸ *PIPE STRAINERS* — Bulletin No. 602 gives details about company's line of Y-type pipe strainers. Literature covers design features, pertinent dimensions of eight sizes of cast semi-steel strainers for pressures to 250 psi, six sizes of carbon moly steel units for pressures to 900 psi, temperatures to 900 F. *Armstrong Machine Works, Dept. HPAC, Three Rivers, Mich.*



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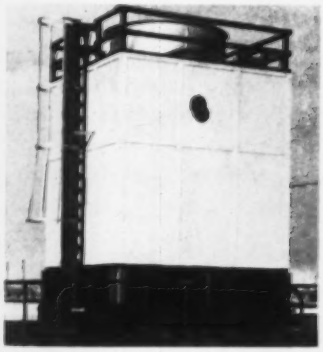

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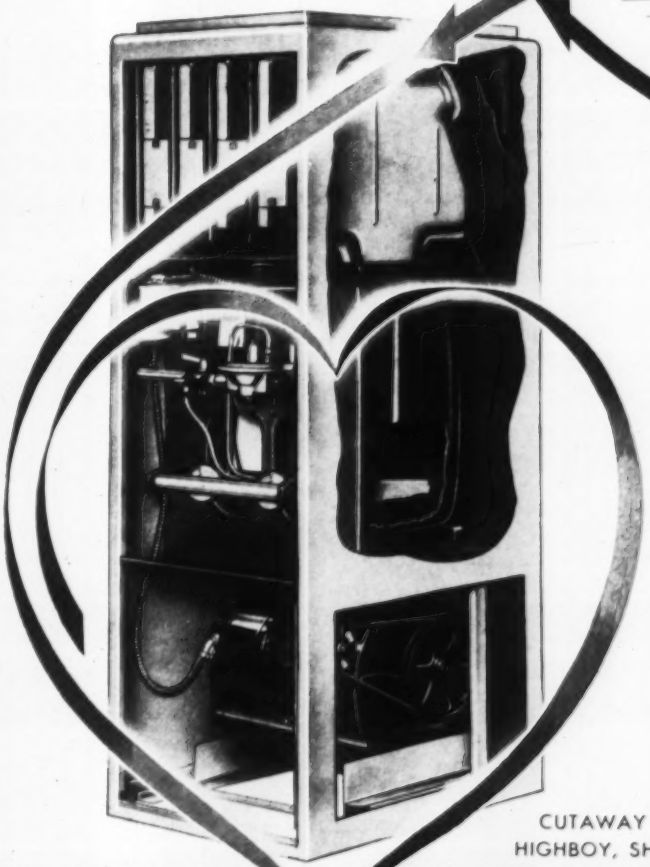

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RECENT TRADE LITERATURE

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▸ *PLASTIC LAMINATE* — Bulletin describes "Kel-F" plastic laminate lining material formulated for application to inexpensive containers, tanks, pipes, etc. Material is fused, flowed into glass fiber cloth backing. *Garlock Packing Co., Dept. HPAC, Palmyra, N. Y.*

▸ *PORTABLE TOOLS* — Catalog for 1956 lists more than 100 models of industrial portable power tools and accessories. Many items illustrated with cutaway drawings to show construction details. *Skil Corp., Dept. HPAC, 5033 Elston Ave., Chicago 30.*

▸ *PRODUCT DIRECTORY* — *This is A-C from A to Z* is 24 page booklet containing alphabetical description of company's products and their descriptive literature. *Allis-Chalmers Mfg. Co., Dept. HPAC, 1171 S. 70th St., Milwaukee.*

▸ *PUMP MOTORS* — Bulletin No. 1903 contains illustrations, technical drawings depicting features applications of various types of vertical turbine pump motors. *U. S. Electrical Motors, Inc., Dept. HPAC, Box 2053, Los Angeles 54.*

▸ *PUMPS* — Pumps for medium and high head services described, illustrated in 8 page catalog A-155. Cross-sections of design shown for bottom suction, side suction types. Construction details included. *C. H. Wheeler Mfg. Co., Dept. HPAC, 19th and Lehigh, Philadelphia 32.*

▸ *PVC PIPE FITTINGS, FLANGES* — Corrosion resistant pipe fittings and flanges in normal impact grade and high impact grade, rigid, unplasticized polyvinyl chloride detailed in 12 page catalog. Literature shows characteristics, advantages, limitations; lists operating pressures, temperatures, dimensions, weights, etc. *Grinnell Co., Inc., Dept. HPAC, 260 W. Exchange St., Providence 1.*

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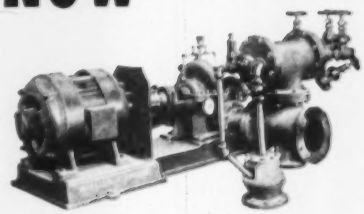

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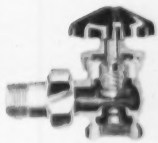

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You probably have made certain Marsh products your standbys without realizing there are a lot more of them just as superlative as the ones you like so well.

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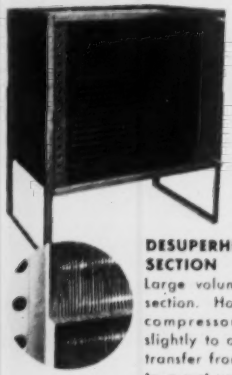

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RECENT TRADE LITERATURE

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▸ *QUICK OPENING DOOR* — New 4 page bulletin No. 2030 describes "Lever-Lok" quick opening door for heat exchangers, sterilizers, autoclaves. Photographs show units in use on horizontal and vertical equipment, with both manual and pneumatic control. *Patterson-Kelley Co., Inc., Dept. HPAC, East Stroudsburg, Pa.*

▸ *RADIANT HEATING CONSTRUCTION* — New 8 page report designed to help architects, engineers, heating and piping contractors in accepted installation procedures for radiant heating systems. Sketches show various types of construction. *A. M. Byers Co., Dept. HPAC, Box 1076, Pittsburgh 30.*

▸ *REFRIGERANT BOOSTER SYSTEMS* — Ammonia and fluorinated hydrocarbon refrigerant booster systems illustrated, described in 20 page bulletin No. 516-E. Covers multi-cylinder type booster compressors, "heavy duty" compressors with two or four cylinders. *Frick Co., Dept. HPAC, Waynesboro, Pa.*

▸ *REFRIGERATION WIRES* — Line of refrigeration wire and cord explained in 4 page brochure. Data concerning size, insulation, dimensions, temperature ratings, construction, approvals included. *Essex Wire Corp., Dept. HPAC, 1601 Wall St., Ft. Wayne.*

▸ *REPAIR OF CAST IRON PARTS* — New 4 page booklet outlines information on welding of cast iron with company's "Ni-Rod" and "Ni-Rod 55." Nine graphic case histories show welding electrodes in action. *International Nickel Co., Inc., Dept. HPAC, 67 Wall St., New York 5.*

▸ *RUBBER, PLASTIC LINING COMPOUNDS* — Folder is "sampler" containing 11 actual specimens of rubber and elastomeric materials

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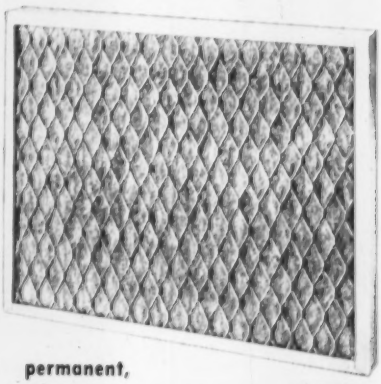

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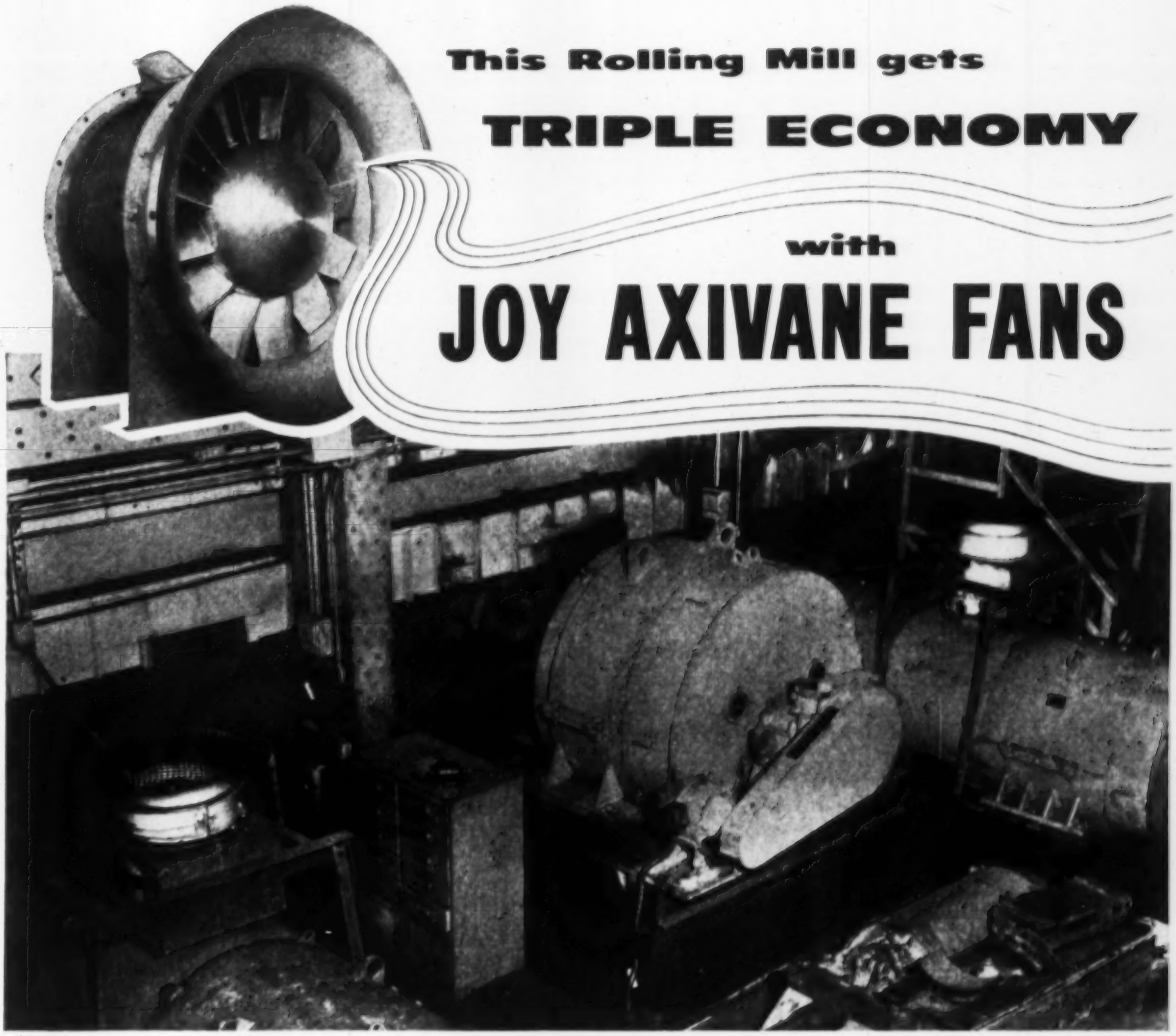
with

JOY AXIVANE FANS



They Save POWER · LABOR · SPACE

A typical example of the adaptability of Joy *Axivane* Fans to unusual ventilating applications is this one in the motor room of one of America's largest rolling mills. An *Axivane* fan is mounted atop each motor housing . . . its job is to cool the windings and other important components of the drive motor.

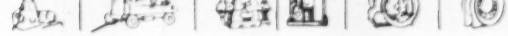
Because of the in-line design of the Joy fans, no elaborate duct system was required . . . installation was considerably simplified. Because a Joy fan is actually built *around* its motor, power-loss from motor to fan is negligible. Space requirements, as shown above, are at the irreducible minimum.

Joy *Axivane* Fans will show you new standards in efficiency, compactness, quietness, and outstanding versatility. There are 156 models for volumes up to 200,000 CFM and pressures to 11" wg. Get the full story by writing to **Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

Write for FREE Bulletin 93-41

Consult a Joy Engineer

for VANEAXIAL FANS · COMPRESSORS · OXYGEN GENERATORS
VACUUM PUMPS AND BOOSTERS



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WORLD'S LARGEST MANUFACTURER
OF VANEAXIAL-TYPE FANS

Specify Raypak

Copper tube forced hot water boilers

...with exclusive gas modulation —sizes the boiler for the job!

Approved by A.G.A.

Complies with A.S.M.E. code

12 Models fit every need

Check these features

Raypak boilers are specifically packaged for Radiant Panel, Baseboard, Radiator, Convector, Swimming Pool and Volume Hot Water Supply Systems and also are ideal companions to Air Conditioning Units.

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Please send me additional information and name of local representative.

Name _____

Occupation _____

Company _____

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City _____ State _____

RECENT TRADE LITERATURE

Continued

compounded, milled, calendered by manufacturer. *Automotive Rubber Co., Inc., Dept. HPAC, 12550 Beech Rd., Detroit 39.*

▶ *RUBBER PRODUCTS* New booklet touches on composition, manufacture of "Hypalon" chemical rubber, outlines characteristics said to insure good performance under severe service conditions, shows material used for hose, belting, seals, coatings. *E. I. du Pont de Nemours & Co., Dept. HPAC, Wilmington, Del.*

▶ *SELECTION OF WATER TREATMENT* Technical reprint T-1.33 covers operating factors, selection of chemical treatment for water clarification. Discusses theoretical chemical problems, goes into actual physical consideration of process. *Graver Water Conditioning Co., Dept. HPAC, 216 W. 14th St., New York 11.*

▶ *SOUND ABSORPTION* "Soundzorber" wire reinforced rubber pipe designed to eliminate noise, vibration from water lines described in catalog SZ-55. Covered are construction features, operating characteristics. *T. R. Finn & Co., Inc., Industrial Div., Dept. HPAC, 200 Central Ave., Hawthorne, N.J.*

▶ *SPEED REDUCERS* Details of line of shaft mounted speed reducers presented in Bulletin CD-100. Dimensioned assembly drawings, horsepower and torque rating charts, application drawings illustrate 12 page booklet. *Cone-Drive Gears Div., Michigan Tool Co., Dept. HPAC, 7171 E. McNichols Rd., Detroit.*

▶ *STEEL* Technical data sheet has 17 charts giving information on the working of tool and high speed steels. Such items as cutting tool angles, table of cutting speeds, temperature ranges and guides included in booklet. *Allegheny Ludlum Steel Corp., Dept.*

CAP CAPITOL 300# FORGED STEEL UNIONS

LISTED UNDER REEXAMINATION SERVICE UNDERWRITERS' LABORATORIES INC. UL

This U.L. Label Guarantees Quality

- Brass or integral steel seat
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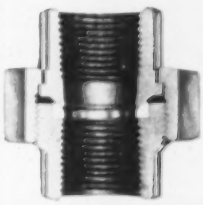
- Smaller sizes machined from solid bar
- Close tolerance
- Meets all Federal specifications



Available from stock in sizes ½" through 2", 300# steam or 2000# cold water, oil or gas, non-shock.

PLUS Capitol's package

extra protection and easier handling at no extra cost means

EXTRA PROFIT

order all your fitting requirements from

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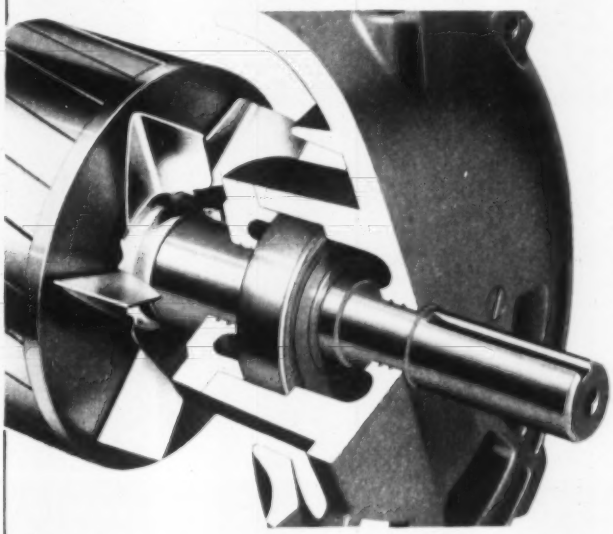
PLUS values in power

in HOWELL series one hundred motors to give you



LONGER MOTOR LIFE

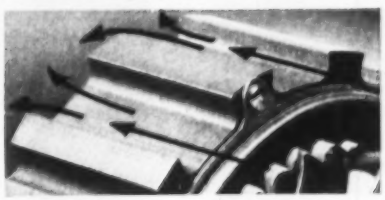
LESS MOTOR MAINTENANCE

When you are specifying motors in the new frame sizes, look at the bearings — they're an important yardstick of motor life and ease of maintenance.

Bearings on Howell Series 100 motors have these double protections: (1) Fully-enclosed end plate cavities with an inner bearing cap that seals out the dust drawn into the motor by the ventilating air stream. (2) Double-shielded bearings insure that any grease contamination is kept out of the races.

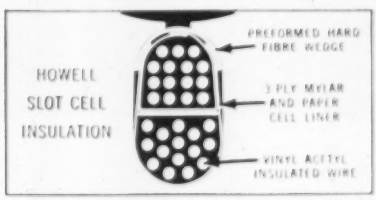
Over-lubrication is virtually eliminated to remove a common cause of bearing failure. With the Howellube system, grease enters and exits on the same side of the bearing — balls are never packed tight by through-flushing. Compare them all . . . then buy the best!

GET THE PLUS values THAT COUNT....specify HOWELL series 100 motors



heat-source ventilation

Wide slots in the stator provide 50% more contact between cooling air and stator laminations, main source of motor heat. Cool running Series 100 motors last longer.



mylar insulated to stand the gaff

Mylar® — for top moisture resistance and 8 times the dielectric strength of paper insulation — protects Series 100 windings under the worst of operating conditions.

*Dupont trademark

smaller, lighter, better looking

Save machine and storage space, save shipping weight, and get new functional streamlining that matches the motor to your most modern machine design or production equipment. Why put up with dust catching fins on a motor, when sleek good appearance costs no more.

For more details on Series 100 motors, write for Bulletin N-100-R

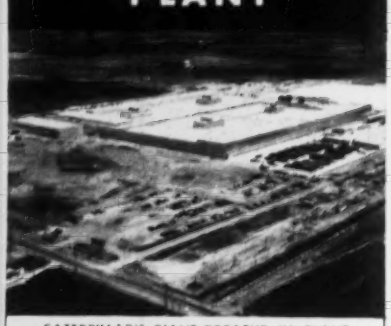
HOWELL Red Band MOTORS

HOWELL MOTORS

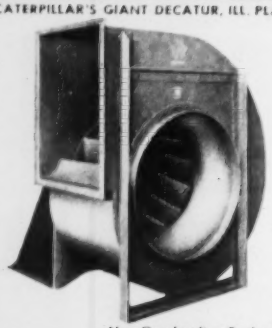
PRECISION-BUILT MOTORS FOR INDUSTRY SINCE 1915

HOWELL ELECTRIC MOTORS COMPANY, HOWELL, MICHIGAN

GENERAL BLOWER EQUIPMENT INSTALLED IN *NEW* Caterpillar PLANT



CATERPILLAR'S GIANT DECATUR, ILL. PLANT



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In 1950 Caterpillar Tractor Co. bought 32 No. 6 DIDW General Blower Co. fans for their new Joliet, Ill. plant. The fans operated so successfully over a four and one half year period that Caterpillar installed 27 General blowers in their huge Decatur, Ill. plant. These fans move 1,220,000 CFM and fully meet all official ventilating requirements.

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GENERAL BLOWER COMPANY

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RECENT TRADE LITERATURE

Continued

HPAC, 2020 Oliver Bldg., Pittsburgh.

▶ *STOCK DIES FOR GASKETS* Designed as practical help to users of gaskets, shim, washers, form No. 33 lists some 1500 dies carried in stock by company. *Chicago Wheel Mfg. Co., Dept. HPAC, 7701 S. Avalon Ave., Chicago 19.*

▶ *SUBMERSIBLE PUMPS* New 20 page cartoon booklet illustrates 14 principle "do's" and "don't's" designed to help installers achieve dependable performance in submersible pump installations. *Franklin Electric Co., Inc., Dept. HPAC, 345 E. Spring St., Bluffton, Ind.*

▶ *SUMP PUMPS* Bulletin No. 103 DS covers packaged type "DSA" sump pumps with capacities to 170 gpm, heads to 70 ft. Includes cutaway drawings, performance curves, proposed specifications, typical dimensions. *Aurora Pump Div. of New York Air Brake Co., Dept. HPAC, Aurora, Ill.*

▶ *TEMPERATURE CONTROLLERS* Revised bulletin No. 1025B describes company's "LSI" electric indicating controller. Operational sketch shows how unit can be used to provide various sequence control combinations. *Sarco Co., Inc., Dept. HPAC, Empire State Bldg., New York 1.*

▶ *TUBING* New 36 page brochure contains data, reference material for company's line of tubing. *Nikoh Tube Co., Dept. HPAC, 5000 S. Whipple, Chicago 32.*

▶ *TUBING, PIPE WELDING* Information on welding of process piping contained in folder TDC-162A. Literature provides data on welding characteristics of austenitic and ferritic types of stainless steels, briefly describes various welding techniques. *Babcock & Wilcox Co., Dept. HPAC, Beaver Falls, Pa.*

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This practical book is made up of outstanding papers and data on industrial piping selected from past issues of "Heating, Piping & Air Conditioning." It is a most comprehensive collection of case studies, showing how various difficult piping problems encountered in different industrial plants were successfully worked out by piping experts.

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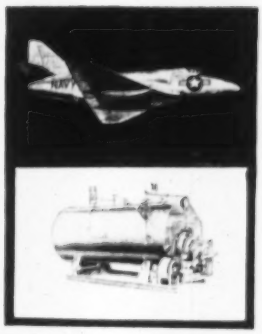
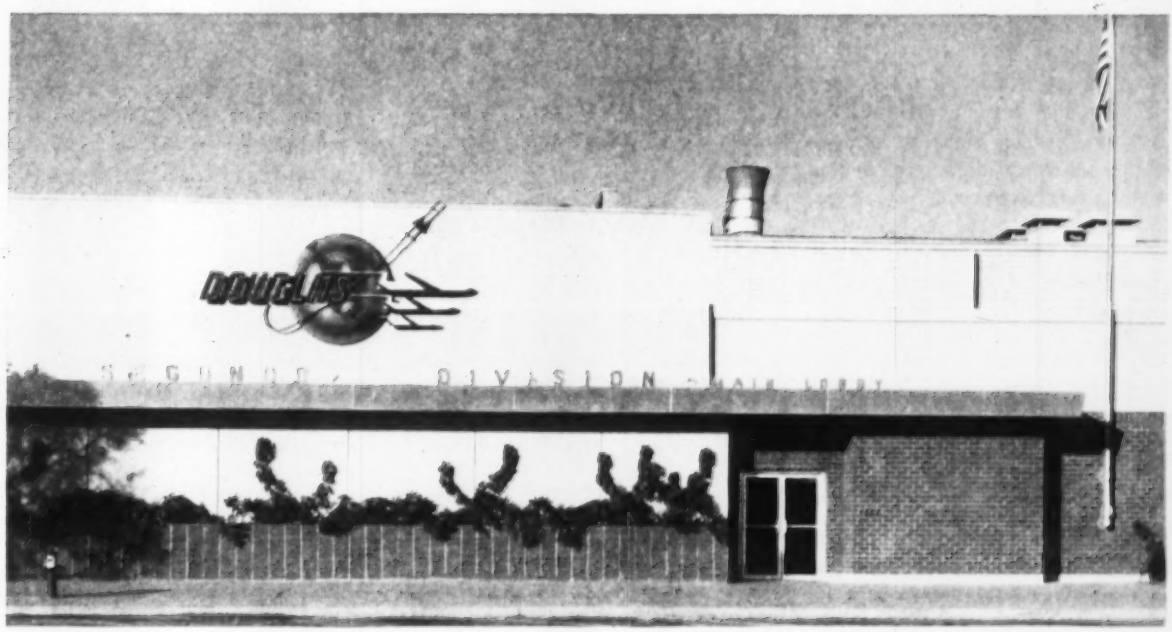


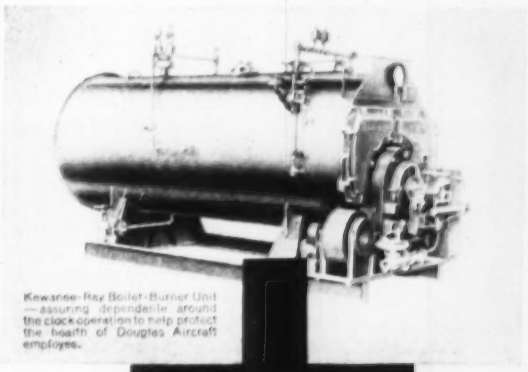
Sisters under the skin . . . when it comes to "cruising speed"



Douglas Aircraft Company, Inc., Division, El Segundo, California
Architect & Engineer: Holmes & Narver, Inc., Los Angeles, Calif.
Heating Contractor: E. Willardson, Inc., Los Angeles, Calif.

■ No one knows the importance of "cruising speed" operation in aircraft better than the Douglas Aircraft people. They know an airplane, to be efficient, to operate economically, to have longer life, must fly at "cruising speed." They know, too, there must be extra reserve power for take-off—for emergencies. So, when it came to boiler selection for the new A4D Skyhawk production facilities at their El Segundo, California Division, it was only natural they turned to Kewanee Reserve Plus Rated Boilers with 50% extra built-in power assuring "cruising speed" operation. For "cruising speed" means less strain—less wear. It means higher efficiency . . . it means lower maintenance and repair costs. Kewanee Boilers are rated on nominal capacity with reserve to take care of normal needs—meet emergencies of the present—fluctuating loads and future expansion. A boiler rated on maximum capacity, operating at constant top speed, requires more maintenance, constant attendance, and finer burner adjustment to maintain efficiency. So, choose Kewanee—for lower fuel and maintenance costs—more efficient "cruising speed" operation.

KEWANEE BOILER DIVISION of AMERICAN-Standard
101 Franklin Street, Kewanee, Illinois


Kewanee-Ray Boiler-Burner Unit —assuring dependable around the clock operation to help protect the health of Douglas Aircraft employes.
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reserve plus rated

KEWANEE BOILERS

You can depend on Kewanee engineering

RECENT TRADE LITERATURE

Continued

▶ *VALVE, FITTINGS* New 6 page circular describes "Lancor" all-molded, corrosion resistant polyvinyl chloride valve and fittings. Information includes cited advantages installation data, dimensions. *Lankenheimer Co., Dept. HPAC, Cincinnati* 14.

▶ *VERTICAL WET PIT PUMP* New 4 page folder outlines company's sound slidefilm, "The Choice is Yours," which uses case histories to discuss applications, construction features of vertical wet pit pumps. Discusses availability of film. *Yeomans Bros. Co., Dept. HPAC, 2000-5 N. Ruby St., Melrose Park, Ill.*

▶ *VIBRATION MOUNTINGS* Line of rubber-in-shear vibration mountings with load capacities 40 to 10,000 lb described in catalog No. RS-55. Literature details "floating action" construction feature. *T. R. Finn & Co., Inc., Dept. HPAC, 200 Central Ave., Hawthorne, N.J.*

▶ *VIBRATION, NOISE CONTROL* Bulletin K6A discusses plant engineering problems such as machine mobility, eliminating floor bolts, leveling machines, eliminating projects, controlling vibration and noise. Case histories presented. *Korfund Co., Inc., Dept. HPAC, 43-01F 32nd Pl., Long Island City, N.Y.*

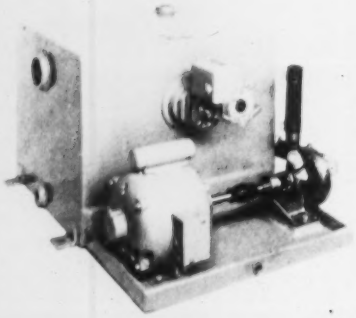
▶ *WATER CONDITIONING* Technical reprint T-144 discusses iron, manganese removal from water supplies. Presents details, engineering layouts of seven different types of iron removal systems. *Graver Water Conditioning Co., Dept. HPAC, 216 W. 14th St., New York* 11.

▶ *WELDER, POWER UNIT* Combination 200 amp welder, 4 kva standby a-c power unit described in 4 page folder. Output ratings, specifications, dimensional drawings of "Weldanpower" unit presented. *Lincoln Electric Co., Dept. HPAC, 22801 St. Clair Ave., Cleveland* 17.

▶ *WELDERS* Specifications, construction features, dimensional drawings for "Shield-Arc" industrial d-c welders presented in 8 page bulletin. Also, four types of undercarriages described. *Lincoln Electric Co., Dept. HPAC, 22801 St. Clair Ave., Cleveland* 17.

▶ *WELDING* Four page bulletin No. 561 on welding says "avoid inefficient methods. . ." and tells correct welding procedures. Portable gun welders in six models illustrated, described briefly. *Taylor-Winfield Corp., Dept. HPAC, Warren, Ohio.*

▶ *WELDING OF ALLOY STEEL* Bulletin S-101 discusses "automatic" welding of alloy steel with mild steel electrode and alloy flux. Lists range of alloying, standard procedures, applications, ordering information. *Lincoln Electric Co., Dept. HPAC, 22801 St. Clair Ave., Cleveland.* ✦



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This high quality unit offers you these outstanding advantages: *low initial cost; far more capacity than any other similar pump at the same price* (to 8000 sq. ft. EDR at 20 psi); *a low return inlet* (to eliminate need for a pit even though return lines are as low as a foot above the floor); *all bronze centrifugal pump* with a nonclogging open impeller, stainless steel shaft; *flexible connectors and coupling* (to isolate the pump, eliminate pipe cramp, wear and noise); *thermal overload protection; a level indicating float switch.*

These advantages — and many more — are yours for the asking with the Eagan Eagle. (other models available with capacities to 100,000 sq. ft. at 200 psi.)

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News about

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THE exceptional physical and chemical properties of pipe and fittings made from Geon rigid vinyl resins have cut costs in many systems and made entirely new applications possible. Here are the reasons:

1. **Resists oil, acids, alkalis, most chemicals.**
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Applications include sour crude oil lines, salt water lines, chemical plant piping, industrial cold water lines, vent pipes for acid fumes and corrosive gases. Vinegar plants, ships at sea, oil fields —all are enjoying the rewards of cheaper and easier installation, lower material cost and longer pipe life under extreme conditions. For ideas on how pipe made from Geon can help you, write Dept. DN-3, B.F.Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

B.F.Goodrich GEON polyvinyl materials • HYCAR American rubber and latex • GOOD-RITE chemicals and plasticizers • HARMON colors

WHO'S WHAT . . .

(New personnel, promotions)

▸ *GRAVER WATER CONDITIONING CO.* Joseph H. Duff, assistant technical manager.

▸ *UNITED STATES AIR CONDITIONING CORP.* Meyer Rosen, vice president of the Floral City heater division of usAIRco, in Monroe, Michigan.

▸ *GENERAL ELECTRIC CO.* Charles R. Pritchard, a vice president; Clifford B. Woodward, Jr., manager-commercial engineering, Weathertron department; Arthur C. Treece, general manager, plastics department; John L. McMurphy, manager, special study-team on the division's insulation businesses.

▸ *PATTERSON-KELLEY CO.* John J. Freymuller, industrial publicity manager.

▸ *BRUNER CORP.* James L. Bruner, vice president.

▸ *ARTHUR D. LITTLE, INC.* Raymond Stevens, president, succeeding Earl P. Stevenson, now chairman of the board.

▸ *MODERN ENGINEERING CO.* Frank N. Phelps, Jr., advertising manager, oxy-acetylene welding and cutting apparatus divisions.

▸ *GARDNER-DENVER CO.* William B. Knoderer, sales manager, industrial division; Neil Martin Fishback, sales manager, mining and contracting division.

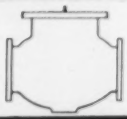
▸ *NATIONAL BUREAU OF STANDARDS* Dr. Hubert R. Snoke, assistant division chief of the building technology division. He will continue as chief of the floor, roof and wall covering section.

▸ *GENERAL CONTROLS CO.* Stanley John Pachyn, assistant sales manager, industrial controls division; John W. Babcock, manager, New Orleans factory branch office; Richard J. Wickert, field engineer, Perfex Div.

▸ *COOLING TOWER INSTITUTE* New officers for 1956 are: James P. Wiseman, president of Fluor Products Company, president; Forrest B. Reed, The Marley Company, vice-president; Karl E. Johnson, J. E. Pritchard & Co., secretary; and Denis E. O'Neil, Foster Wheeler Corporation, treasurer. Also serving

YOU JUDGE THE BETTER BUY!

FOR A 6" VALVE INSTALLATION OPERATED AN AVERAGE OF 55 TIMES A DAY FOR 9 YEARS



Case History	GATE VALVE "A"	G.A. FLOWTROL VALVE
REPAIRS	FREQUENT	NONE
REPLACEMENT	EVERY 3 MONTHS	NONE
ORIGINAL COST	$60.00	$360.00
APPROXIMATE TOTAL COST	over $2,000.00	$360.00

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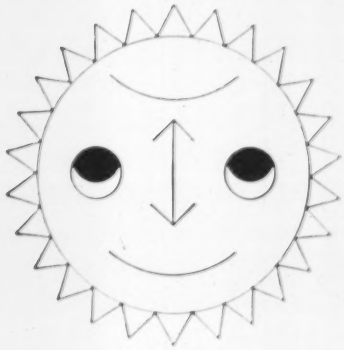
Designers and Manufacturers of **VALVES FOR AUTOMATION**

The tragic fact, our doctors tell us, is that every third cancer death is a needless death... *twice* as many could be saved.



LET'S LOOK AT THE BRIGHTER SIDE

Many thousands of Americans are cured of cancer every year. More and more people are going to their doctors *in time*...To learn how to head off cancer, call the American Cancer Society or write to "Cancer" in care of your local Post Office.

American Cancer Society

READ ABOUT THE SWING TO *SIL-FOS* BRAZED NON-FERROUS TUBING

This bulletin tells you about important new buildings in which top-ranking contractors installed SIL-FOS brazed non-ferrous tubing systems — and WHY.

If you have anything to do with building design and construction; you will be interested in the information in this bulletin. WRITE for a copy today. Ask for "Brazing News No. 71."

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ON THE
Booming Florida Scene
DRAYER-HANSON AIR CONDITIONING

MORE

Seville Hotel, Miami Beach. Architect: Melvin Grossman/Air Conditioning Engineer: Sam L. Hamilton.

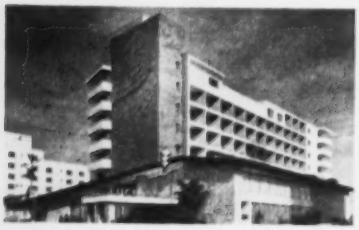
AND MORE

Hollywood Beach Hotel, Hollywood Fla. Architect: Melvin Grossman/Engineers: Sasnett Engineering.

AND MORE

Belle Isle Apartments, Miami Beach. Architect: Robert B. Swartburg/ Engineers: Altec Engineering Co.

AND MORE



Lucerne Hotel, Miami Beach. Architect: Carlos B. Schoeppl/Engineers: Altec Engineering Co.

A sure sign of the times in Florida — "Air Conditioning by Drayer-Hanson"!... in a wide variety of installations: the new Biscayne Shopping Plaza, La Gorce Country Club, Miami Sheriff's Station, El Sirocco Motor Hotel, many more. Marked advantages to meet any requirements with D-H Flexazone systems! Spotaire systems! HH and HHV systems!

Request catalogs

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(Division of National - U.S. Radiator Corporation)

WHO'S WHAT

Continued

on the executive board are Paul R. Hoffman, Lilie-Hoffmann Cooling Towers, Inc., and Ennis C. Smith, Hudson Engineering Corp.

▸ *LOF GLASS FIBERS CO.* Donald L. McClure, director of industrial relations.

▸ *H. K. PORTER CO., INC.* Charles L. Holbert, a vice president with headquarters in Pittsburgh.

▸ *OWENS-CORNING FIBERGLAS CORP.* Eleven branch sales managers of Owens-Corning have been named to the "Fiberglas" President's Sales Club. The members and their branches are: William P. Johnson, Atlanta, chairman; R. C. Burgess, Grand Rapids; W. J. Clark, formerly Philadelphia manager, promoted late in 1955 to manager of industrial textiles sales division; R. L. Cone, Jr., Toledo; Charles E. Eagen, Milwaukee; James E. Higgins, Chicago; D. W. Ladd, Jr., New York; G. O. Mabry, Kansas City; Carl H. Ramien, Florida; John A. Tallman, Jr., Portland; and R. M. Meechan, manager of Portland Fiberglas engineering and contracting division.

▸ *TYPHOON AIR CONDITIONING CO., INC.* Larry Spence, district manager for the midwest area, awarded Typhoon's 1955 distinguished salesman award.

▸ *CARRIER CORP.* Hermann C. Hoffman and Robert C. White, general sales manager and chief product specialist, respectively, of machinery and systems division.

▸ *ORANGEBURG MFG. CO., INC.* John J. Halvorsen, manager of sales and development of company's new plastic pipe division.

▸ *FLEXIBLE TUBING CORP.* Ernest W. Bush, industrial engineer.

▸ *GATES ENGINEERING CO.* Harry C. Burger, vice president of operations.

▸ *CRANE CO.* Edward H. Petersen, treasurer; Norman I. Pickles and Robert F. McDonald, assistant treasurers.

▸ *TRIANGLE CONDUIT AND CABLE CO.* Frank M. Deiner, advertising manager, succeeding William F. Coursen.

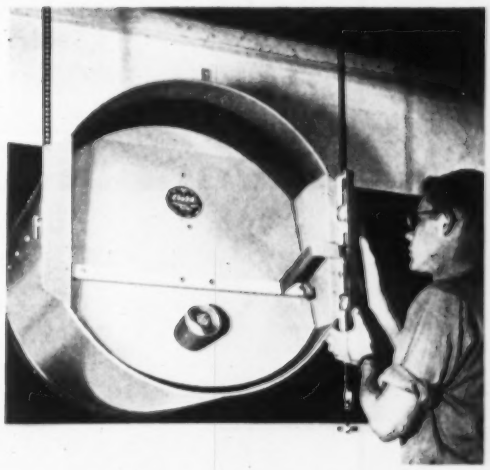
▸ *EUTECTIC WELDING ALLOYS CORP.* Joseph Hambuechen and Noel B. McLean, elected to board of directors; Harley Erickson, production manager;

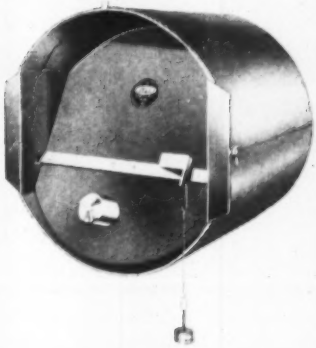
DEPENDABLE,
PRECISELY ACCURATE

Draft Control

for coal fired, oil fired, gas fired or gas-oil fired

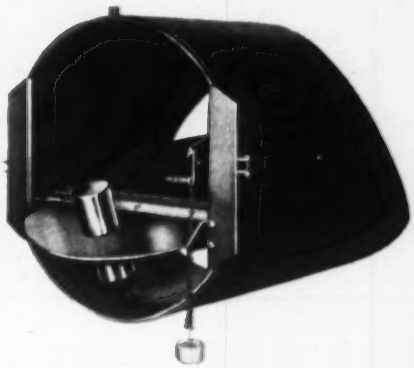
HEATING PLANTS





FIELD TYPE "M" for coal and oil fired heating plants

Heavy duty commercial model in 28" and 32" sizes. Heavy, rigid construction assures long, trouble free service. Stainless steel knife edge bearing for permanent sensitivity. Also available in 6" through 24" sizes for domestic and commercial installations. First choice of heating men — the round control you can level on any flue.



FIELD TYPE "MG" for gas and gas-oil fired heating plants

A heavy duty, precision built control in sizes 8" through 32" for commercial and industrial installations. Stainless steel knife edge bearings for permanent sensitivity. Gate opens inward to regulate updrafts, and outward to relieve down-drafts. Optional safety switch available where codes require. Fully proven, accepted virtually everywhere.

They're real HEAVYWEIGHTS

Compare the weight of a Field Control to any other available. Here is proof of the massive, welded construction, long, vibration-free service, that permits Field's supreme accuracy.

Size Control	Gate	Thickness of Parts Side Plates	Ring	Collar	Wt. without Ctn. or Crate
14 M	16 Ga.	16 Ga.	$\frac{5}{8}$ x 2"	22 Ga. Galv.	19#
16 M&MG	16 Ga.	16 Ga.	$\frac{5}{8}$ x 2"	18 Ga. Galv.	28#
18 M	16 Ga.	16 Ga.	$\frac{5}{8}$ x 2"	18 Ga. Galv.	35#
20 M&MG	16 Ga.	16 Ga.	$\frac{1}{4}$ x 2"	18 Ga. Galv.	41#
24 M&MG	14 Ga.	16 Ga.	$\frac{1}{4}$ x 2"	18 Ga. Galv.	65#
28 M&MG	14 Ga.	14 Ga.	$\frac{1}{4}$ x 4"	14 Ga. H.R.S.	110#
32 M&MG	14 Ga.	14 Ga.	$\frac{1}{4}$ x 4"	14 Ga. H.R.S.	140#

See our complete new exhibit at the National Oil Heat and Air Conditioning Exposition at the New York City Coliseum, June 11-15, 1956. Space No. 246.

field

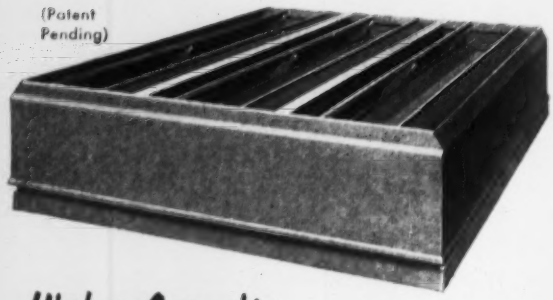
FIELD CONTROL DIVISION
of H. D. CONKEY & COMPANY, Mendota, Ill.

Affiliates
Conco Building Products, Inc. - Brick, Tile, Stone
Conco Materials Handling Division - Cranes, Hoists

Swartwout's *New*

Contouramic Airmover® Roof Ventilator

(Patent Pending)



Higher Capacity

gravity ventilation now achieved with less bulk and weight . . .

and at lower cost!

You get fifteen years of research and scientific designing in this new Contouramic Airmover . . . and it shows up in the new size and shape . . . and a terrific boost in performance. It has automatic damper-opening in case of fire, too! Here is today's outstanding ventilator development.

Only 21½ inches high from the roof curb — nearly a foot lower — this new Airmover is lighter, easier to install, and absolutely wind-and-weather safe. Easier to clean and maintain. It's flexible as ever — single units for "spot" ventilation or single or double runs when you want your whole roof to breathe.

And contrary to today's trends, the cost is down! Write or wire for Form 312F today.

Here it is— summed up in ten outstanding features

1. Higher Capacity
2. Lower Cost
3. Easier to Install — and at Less Cost
4. Less Weight
5. Lower — only 21½" high
6. Less Wind Resistance
7. Automatic Opening in Case of Fire
8. Absolutely Weatherproof
9. Nylon Bearings
10. Lower Maintenance

18511 Euclid Avenue, Cleveland 12, Ohio

The Swartwout Co.

Roof Ventilators and Ventilating Louvers

AUTRONIC PROCESS CONTROL EQUIPMENT

WHO'S WHAT

Continued

Aaron Rupp, district engineer, recipient of distinguished salesman's award.

▸ *AMERICAN WELDING SOCIETY*—New officers for the 1956-57 fiscal year beginning June 1 are: John J. Chyle, director of welding research, A. O. Smith Corp., president; Clarence P. Sander, general superintendent, Vernon plant, Consolidated Western Steel Div., United States Steel Co., first vice president; Gustav O. Hoglund, head of welding section, Alcoa Process Development Laboratory, Aluminum Company of America, second vice president.

▸ *SERVEL, INC.*—G. O. Kuhen, assistant product director for year 'round air conditioning; Harold J. Luke, assistant to the vice president in charge of finance.

▸ *ECONO PRODUCTS CO.*—Devereaux Martin, vice president, engineering and research.

▸ *ELLIOTT CO.*—John W. Anne, head, Jeannette Div., which includes the Crocker-Wheeler industrial motor division.

▸ *DELAVAN MFG.*—William C. Hunsicker, sales engineer.

▸ *PITTSBURGH CORNING CORP.*—Ambrose B. Murphy, to assist in the sale and promotion of "Foamglas" insulation in industrial and low temperature applications, and to act as advisor to engineers, architects and contractors in this field.

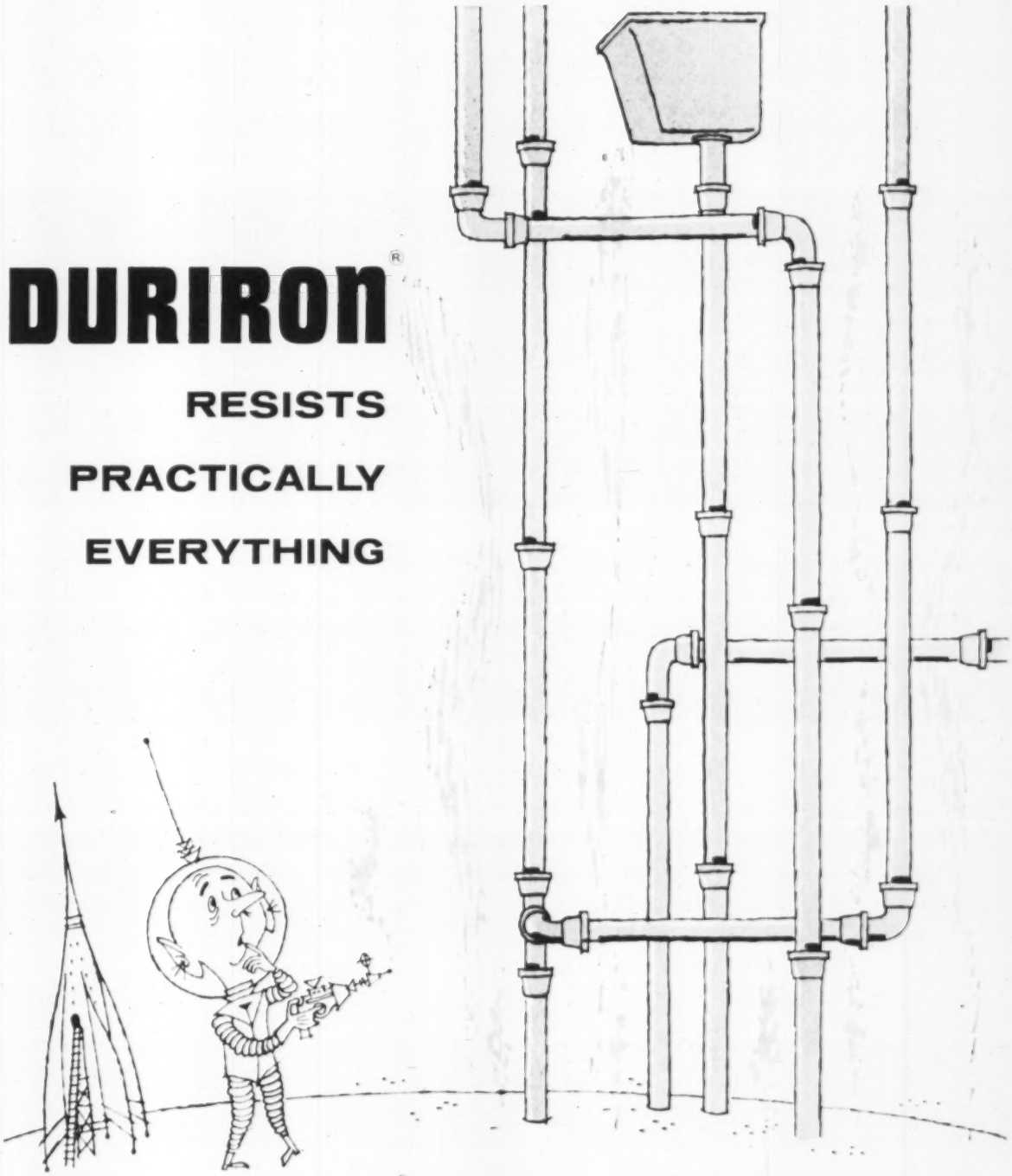
▸ *MAGNESIA INSULATION MANUFACTURERS ASSOCIATION*—Ernest Muehleck, Keasbey & Mattison Co., reelected chairman of the board of governors; Utley W. Smith, Ehret Magnesia Mfg. Co., chairman of the engineering and research committee; William P. Gibbons, Johns-Manville, chairman of the publicity committee.

▸ *ANSUL CHEMICAL CO.*—John Bopp, manager, new products division, refrigeration sales development department.

▸ *A. M. BYERS CO.*—J. Frederic Byers, Jr., president. Formerly executive vice president, Mr. Byers succeeds A. B. Drastrup, resigned as president and director. Robert J. Briemont has been named manager, engineering service department.

DURIRON®

RESISTS PRACTICALLY EVERYTHING



DURIRON® ACIDPROOF DRAIN PIPE

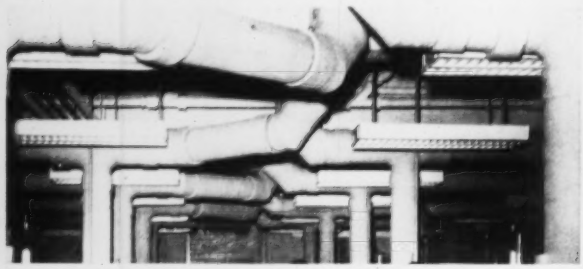
Duriron is *the* high silicon iron specified by architects and engineers for more than thirty years for permanent corrosive waste disposal lines. Duriron is corrosion resistant to practically all commercial acids and other corrosive solutions. Duriron is ideal for schools, hospitals, laboratories, commercial kitchens . . . wherever *permanent* waste disposal lines are required.

DURIRON

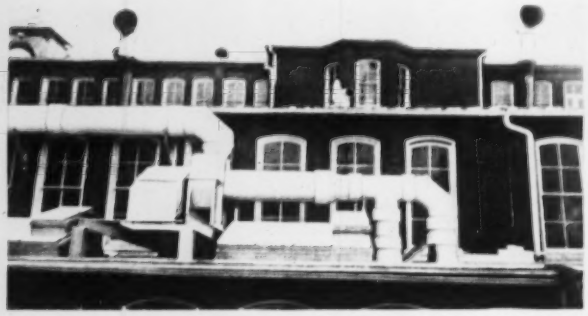
LOOK FOR THE NAME ON EVERY PIECE

THE DURIRON COMPANY, INC.
DAYTON, OHIO

Lick vent problems...



caused by corrosion...



...and by weather

with

TRANSITE INDUSTRIAL VENT **PIPE**

WITH Transite® Industrial Vent Pipe you're sure of long, trouble-free service—thanks to the twofold protection it provides:

INSIDE, Transite protects against the corrosive action of fumes, vapors and dusts that must be removed from research laboratories and industrial plants.

OUTSIDE, it protects against all kinds of weather! Never needs painting or other preservative coatings. Needs no maintenance.

Transite Industrial Vent Pipe offers other advantages, too. A wide variety of fittings and pipe sizes makes it adaptable to every industrial venting service. The ease with which this pipe can be cut and handled on the job makes for important installation economies.

For additional information about the use of Transite Industrial Vent Pipe for your venting problems—inside and out—write to Johns-Manville, Box 60, New York 16, N. Y. In Canada, Port Credit, Ont.

Johns-Manville

TRANSITE INDUSTRIAL VENT **PIPE**

AN ASBESTOS-CEMENT PRODUCT

WHO'S WHAT

Continued

▶ *AMERICAN SOCIETY OF MECHANICAL ENGINEERS*—John Thomas Reid, research manager.

▶ *AVERY ENGINEERING CO.*—Joseph E. Wilhelm, executive vice president; Dennis Boggs, vice president; John Thomas Avery, vice president and secretary; James N. Sampson, assistant vice president; Ethel Haskell, treasurer and assistant secretary.

▶ *REDMOND CO., INC.*—Appointments at new plant at Angola, Ind. are: Annas Laurent, plant superintendent; Daniel Murphy, production control supervisor; John Tomancik, plant engineer.

▶ *MERCOID CORP.*—Willis E. Jones, sales manager; Paul J. Provost, manager of industrial controls division; G. R. Folds, Jr., assigned to work with Mr. Provost.

▶ *NATIONAL U. S. RADIATOR CORP.*—Fred S. Hudson, general manager of sales for heating and air conditioning division.

▶ *AMERICAN GILSONITE CO.*—Ernest T. Smith, head, "Gilsulate" service section.

▶ *YORK-SHIPLEY, INC.*—W. Douglas Read, assistant to the president.

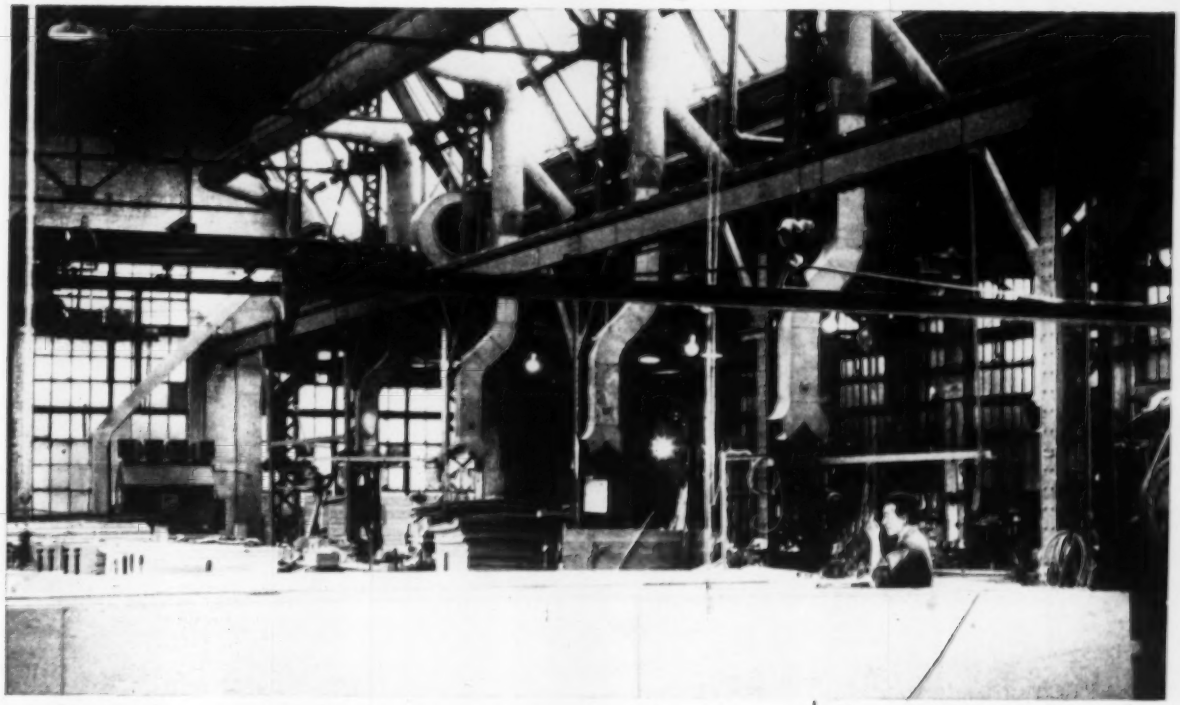
▶ *SQUARE D CO.*—Robert L. Chandler, plant manager, Royal Oak, Mich., plant.

▶ *BUKESHA MOTOR CO.*—C. K. Jones, assistant manager of purchases; Melvin C. Erickson and Paul E. Mantz, chief engineer and assistant sales and service manager, respectively.

▶ *ILG ELECTRIC VENTILATING CO.*—W. H. Rietz, president; J. M. Frank, chairman of the board; Byron L. Casey, director of the company; J. J. Friedler, executive vice president; Charles F. Rietz, vice president in charge of production; Robert E. Parker, vice president in charge of research; S. E. Heverick, vice president in charge of purchasing; and C. W. Dexter, vice president in charge of sales promotion and export.

▶ *DELHI MFG. CO.*—Don Long, quality control manager; George Oster, chief inspector succeeding Mr. Long.

▶ *INDUSTRIAL ACOUSTICS CO., INC., DELIKING INSTRUMENTS, INC.*—Walter F. Ring, project manager.



Richards-Wilcox more than doubles heating capacity

...cuts heat operating costs in half!

Plant heating problems first began for the Richards-Wilcox Manufacturing Co. of Aurora, Illinois, during World War II. Then, the existing steam plant, operating at full capacity, could not meet the heat requirements for new production areas. Immediate solution was the addition of two warm air space heaters.

Later, a 750,000 btu Dravo *Counterflo* heater was installed to serve additional expansion. But in 1951, facing even more expansion, Richards-Wilcox plant men thoroughly surveyed their total plant heating problem.

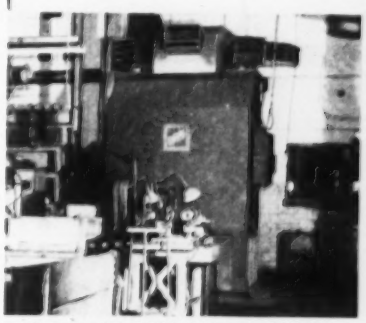
The existing boiler had to be modernized, an additional boiler and accessory equipment had to be added. Operating costs of this contemplated step were discouragingly high! Experience with space heaters suggested an alternative that promised real economies—dismantling of the steam plant and converting the entire plant to warm air heating. This plan was adopted on a 3 year basis.

From 1951 through 1953, twenty-four Dravo *Counterflo* heaters were put into service. Richards-Wilcox personnel installed recording instruments on every unit to determine fuel consumption and efficiency. After two years of service, the records show that Dravo heaters provided more than enough heating capacity for complete worker comfort and had *cut operating costs to less than half of the former system.* Service costs, too, were 50% less than anticipated.

Such economy is only a part of the many exclusive advantages Dravo heaters can bring in heating your plant, warehouse or building. It will pay you to thoroughly investigate quality Dravo heating systems—and see the dollars and cents reasons behind every feature. For prompt information, mail the coupon today.

▲ This Dravo *Counterflo*, on the far wall, distributes heat up to 150 feet away. Richards-Wilcox's complete Dravo system of 25 units provides 21,700,000 btu per hour to a 6 acre plant area. Ductwork visible is part of abandoned steam heating system.

At the Richards-Wilcox plant, Dravo heaters serve dual heating jobs—heating both the local area and, through duct take-offs, serve adjacent areas. ▼



Dravo Corporation, Department A-1405
Fifth & Liberty Avenues
Pittsburgh 22, Pa.

I am interested in Dravo Heaters for

Please send literature

Please have a representative call

Name

Company

Address

City Zone State

DRAVO
CORPORATION
Pittsburgh 22, Pennsylvania
Representatives in principal cities

WHO'S WHAT

Continued

▶ *WESTINGHOUSE ELECTRIC CORP.*—A. C. Meixner, sales manager, transportation and generator division, succeeding J. B. Walker, sales manager, apparatus products.

▶ *WEIL PUMP CO.*—Richard T. Sheridan, executive vice president. Mr. Sheridan will continue as director of national sales.

▶ *AMERICAN AIR FILTER CO., INC.*—George C. Rodgers, manager, engineer and compressor department. Mr. Rodgers will continue as manager of military products.

▶ *BORG-WARNER CORP.*—Stephen L. Ingersoll, president and general manager, Ingersoll Steel Div. He succeeds H. G. Ingersoll, retiring from that position.

▶ *CHEMPUMP CORP.*—William W. Drake, head, market development department.

▶ *PENNSYLVANIA SALT MFG. CO.*—Bruce W. Wilson, sales supervisor, steel and tin mill accounts.

▶ *AIR MOVING AND CONDITIONING ASSOCIATION, INC.*—New officers: R. W. Nelson, American Air Filter Co., Inc., director and president; J. F. Snow, Davidson Fan Co., director and vice president; C. C. Cheyney, Buffalo Forge Co., director and vice president; M. L. Aitken, Robbins & Myers, Inc., director; W. H. Rietz, Ilg Electric Ventilating Co., director and secretary-treasurer; H. F. Brinen, Young Radiator Co., director; W. H. Rutter, Burt Manufacturing Co., director.

▶ *AEROVENT FAN CO., INC.*—C. Richard Sword, sales manager.

▶ *JOSEPH T. RYERSON & SON, INC.*—Harry L. Sturla, Jr., manager, market research department.

▶ *HAYS CORP.*—Frederick M. Rutledge, chief control engineer; Crayton H. Schwestka, chief design engineer.

▶ *CONVECTOR MANUFACTURERS ASSOCIATION*—New officers for 1956 are: J. M. Whalen, convector sales manager, Trane Co., president; R. S. Rickabaugh, heating products division sales manager, Tuttle & Bailey, Inc., vice president; R. E. O'Rourke, secretary-treasurer.

New compactness in air-cooled AIR CONDITIONER design!

Smallest air-cooled, self-contained (not remote) 5-ton central type unit made.

5 natural wood-grain finishes available on all free-standing models.

Completely automatic, thermostat controlled, air-cooled condenser.

MODEL RO-525A
(with air distribution head)

MODEL NO.	NOMINAL CAPACITY	TOTAL COOL. B.T.U.	COOLING C.F.M.	OUTSIDE DIM.
FL-2	2 Ton	24,000	900 @ .3 S.P.	30W×21D×43H
RO-26	2 Ton	24,000	1000 @ .3 S.P.	30W×21D×34H
RO-31	3 Ton	36,000	1200 @ .2 S.P.	30W×23D×38H
RO-31 H.P.	3 Ton	37,700	1400 @ .3 S.P.	30W×25D×40H
RO-525 A	5 Ton	65,500	1800-2400 @ .3 S.P.	40W×26D×57H

Thermostat has 3 positions: Continuous – Automatic, Fan & Compressor – OFF.

Complete air conditioning for entire home — or equivalent commercial or office area — at the lowest cost in smallest space! GENERAL AIR CONDITIONERS deliver 2, 3 or 5 tons of cooling. All models operate on standard outlet (220 V, single and 3 phase except 2-ton — single phase only).

Attic, roof, outside, or free-standing units

NATIONWIDE SALES AND SERVICE

Offices and warehouses:
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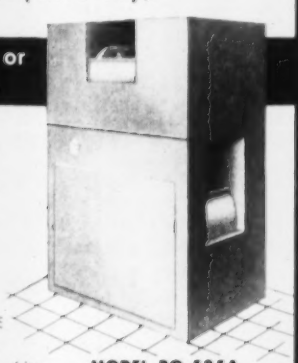
WRITE today for details. Franchise dealerships available.

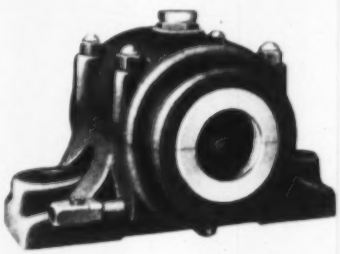


MODEL RO-525A
(without air distribution head)

Main Office
GENERAL AIR CONDITIONING CORP.
Dept. S-23 • 4542 E. Dunham St.
Los Angeles 23, California

FIVE YEAR GUARANTEE — easy payment plan

Bright Lights–That Never Fail



SLEEVOIL BEARINGS

Dodge Sleevoil Bearings are available in plain type, water-cooled, or air-cooled for outside use—all self-aligning—all drilled for thermostatic emergency warning. Shaft sizes from 1-7/16" to 10".

The brilliant lights of Broadway match the stars in the certainty of their rising. A black-out from power failure is almost unthinkable.

One factor that contributes to the dependability of this steady power supply is the bearing that insures unfailing operation of mechanized draft in the generating plant.

These Bearings are Dodge Sleevoil.

Generating plants throughout America—including those in such metropolitan centers as New York, Detroit, San Francisco, Los Angeles—use these super-quality bearings.

The Sleevoil Bearing is a Dodge development, created especially to meet the exacting requirements of fan and blower service. You are invited to write us for our new Engineering Catalog D56, which contains detailed description, sizes, dimensions.

DODGE MANUFACTURING CORP., 1600 Union St., Mishawaka, Indiana

CALL THE TRANSMISSIONEER, your local Dodge Distributor. Factory trained by Dodge, he can give you valuable assistance on modern power transmission machinery for *modern* installations. Look for his name under "Power Transmission Equipment" in your classified telephone directory.

DODGE

of Mishawaka, Ind.

WHERE DO YOU PLACE YOUR TRUST

IN DOUBT OR IN SECURITY ?

When it comes to the welding of Pipe, Valves or Fittings Why take a chance on ruining an Expensive piping system, fitting or Joint when ROBVON Backing Rings Eliminate Doubt from Welding Operations.

ROBVON BACKING RINGS ASSURE

- *PRECISE CLOSE TOLERANCE FIT-UP*
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Available in Carbon Steel, Wrought Iron, Chrome Alloys, Stainless Steel, Aluminum.

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BULLETIN 56-2 and FOLDER No. 1

ROBVON

THE ROBVON BACKING RING CO.
675 GARDEN STREET • ELIZABETH, NEW JERSEY

WHO'S WHAT

Continued

▸ *CLEAVER-BROOKS CO.* Robert E. Sullivan, supervisor of a newly formed sales department handling the sale of commercial heating boilers.

▸ *TRANE CO.* R. G. Miner, Jr., E. T. Neubauer and A. M. G. Moody, chief engineers of the controls and electrical, reciprocating compressor and centrifugal compressor phases, respectively, of the product development program.

▸ *TORK CLOCK CO., INC.* Henry F. Zuba, to head new refrigeration control department.

▸ *REVCOR CO.* Robert F. McCall, national sales manager.

▸ *WINDMASTER CO.* Norwood S. Hearn, sales manager.

▸ *WILLIAM WALLACE CO.* Robert A. McHugh, sales manager of standard lines and western district manager for Metallbestos Div., Frank Kohles, sales manager, Metallbestos Div., replacing George B. McClellan, deceased.

▸ *FLEXONICS CORP.* Howard W. Griesbach, vice president in charge of aircraft and bellows manufacturing; Frank J. Rupp, sales manager, bellows division.

▸ *IMANA REFRIGERATION, INC.* Stanley J. Chastain, production department; Richard F. Sharp, engineer.

▸ *BITUMINOUS COAL RESEARCH, INC.* Robert J. Grace, Franklin D. Cooper, Robert D. Harris and James W. Jacoby, appointed to staff.

▸ *AURORA PUMP DIV., NEW YORK AIR BRAKE CO.* Robert B. Taggart, manager.

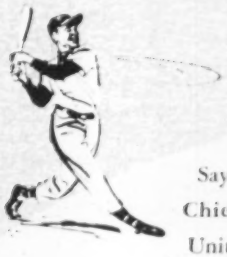
▸ *HOLMES & NAREER, INC.* Thomas W. Burtt, vice president in charge of engineering and construction.

▸ *BUSH MFG. CO.* Deane R. Keuch, application engineer; Edwin A. Carell, application engineer on specialized heat transfer products.

▸ *HOOKER ELECTROCHEMICAL CO.* Herbert R. Downs, design engineer.

▸ *CONOFLOW CORP.* M. Mark Watkins, board of directors.

"You can't get a Better Boiler Box Score"



Says Stanley D. Loomis, Chief Engineer of The United Piece Dye Works, a leader in the field of textile dyeing, finishing and printing. Of course, he's referring to the C-E Package Boiler, Type VP—installed in the newest and most modern United Piece Dye Mill at Charleston, South Carolina. His box score for 1955 appears at the right.

SCORE CARD

AT BAT

3 shifts a day, 6 days a week without a single unscheduled outage.

RUNS

around the clock with a quick response to load change and an ability to sustain a high overload capacity while producing high quality steam.

HITS

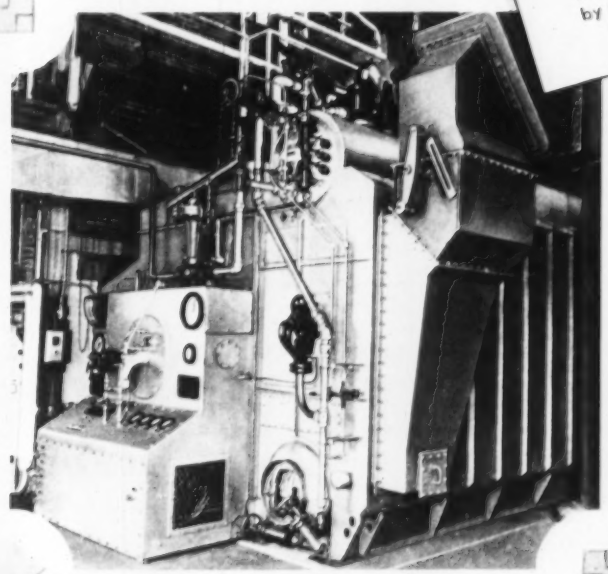
the performance mark. C-E's prompt service and complete cooperation matches the quality of the boiler.

PUT OUTS

of maintenance and repair bills are assured by the boiler's conservative design and built-in advantages. To date there have been no repair bills at all.

ASSISTS

in the continued full-production operation of the plant by meeting every steam need unfailingly.



Need a Package Boiler? See C-E! You can't get a better boiler box score.

B-9118

COMBUSTION ENGINEERING

Combustion Engineering Building — 200 Madison Avenue, New York 16, N. Y.

CANADA: COMBUSTION ENGINEERING-SUPERHEATER LTD.

STEAM GENERATING UNITS • NUCLEAR REACTORS • PAPER MILL EQUIPMENT • PULVERIZERS
FLASH DRYING SYSTEMS • PRESSURE VESSELS
HOME HEATING AND COOLING UNITS • DOMESTIC WATER HEATERS • SOIL PIPE

WHO'S WHAT

Continued

▸ *DELCO APPLIANCE DIV., GENERAL MOTORS CORP.*—John T. Tighe, assistant sales manager for appliances.

IN THE TERRITORIES . . .

(Recent sales appointments)

▸ *L. J. WING MFG. CO.*—Sales representatives and the territories to which they are assigned are: Power and Combustion, Inc., much of Maryland; Gulf-South Engineering Co., northern and central Alabama; Bell and Co., southern Alabama.

▸ *LAU BLOWER CO.*—E. C. Wolford, eastern district sales manager.

▸ *LEBVT AIR CONDITIONER CORP.*—Di Clemente-Voike, Inc., distributor for nine upstate New York counties.

▸ *DELCO APPLIANCE DIV., GENERAL MOTORS CORP.*—E. Conner Johnson, manager of newly created mid-Atlantic region comprised of Maryland, District of Columbia, Virginia, northern North Carolina, eastern Tennessee.

▸ *AMERICAN BLOWER CORP.*—McCombs Supply Co., distributor for self contained air conditioning units in central southeastern Wyoming, southwestern South Dakota, western Nebraska, western Kansas; Marbut Co., a similar appointment covering central and southern Georgia, north central Florida.

▸ *AMERICAN RADIATOR & STANDARD SANITARY CORP.*—William H. Clayton, district manager for air conditioning division for southern United States.

▸ *DETROIT CONTROLS CORP.*—Paul J. Steigerwald, Cleveland territory representative.

▸ *KRITZER RADIANT COILS, INC.*—Representatives for North and South Carolina are: Howard V. Caton Co. and Richard K. Hunter & Co.

▸ *KENNARD CORP.*—Sweiger-Davidson Co., to cover Chicago and immediate trading area.

▸ *PITTSBURGH CORNING CORP.*—Maurice G. Hill, sales representative, Kansas City office.

BRIGHT IDEA! COMBINE LIGHT FIXTURES WITH KNO-DRAFT AIR DIFFUSERS

Shown is the two-story main lounge of Men's Residence Hall at the University of Washington, Seattle. Regular Kno-Draft Air Diffusers with pendant light fixture adaptations are used to achieve design simplicity and assure an uncluttered ceiling.

Kno-Draft Air Diffusers also offer the advantage of complete adjustability *after* installation. This assures *uniform temperature without drafts* throughout the conditioned area, and saves considerable preliminary slide-rule figuring.

There are Kno-Draft round, square and slotted units to meet all architectural and engineering requirements—the industry's most complete line of engineered air diffusers. Attach coupon to your letterhead and mail today for full information. Connor Engineering Corporation, Danbury, Connecticut.

kno·draft®
adjustable air diffusers

Young, Richardson, Carleton & Detlie, Architects and Engineers

Connor Engineering Corp., Dept. G-56, Danbury, Conn.

Please send data on Kno-Draft Air Diffusers. I am particularly interested in: ☐ round ☐ square ☐ slotted ☐ light fixture adaptability ☐ high pressure systems.

Name _____

Company _____

Address _____

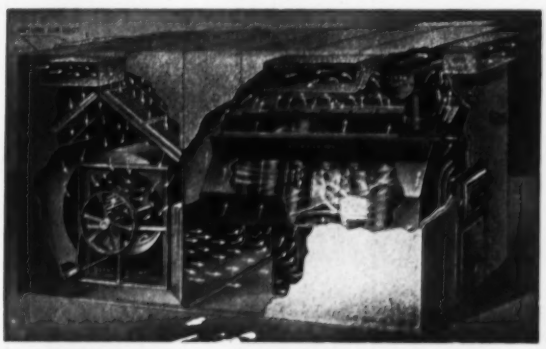
City _____ Zone _____ State _____

WARM AIR HEATED... by Campbell

Trinity Reformed Church, Pella, Iowa, heated with a Campbell No. 8100 combination oil and gas-fired unit. Architect, Savage and Ver Ploeg, Des Moines; Heating Contractor, G. H. Vandenberg and Co., Pella.

FOUR IMPORTANT ADVANTAGES

Campbell 8000 Series units offer four important advantages for installation in churches, schools and other public buildings. Campbell Heaters are surprisingly low in first cost. They deliver exceptional fuel economy. They are designed for easy, low cost installation. And they provide the full benefit of all the natural advantages of warm air heating; positive control of temperature, humidity and ventilation, and easy adaptability for summer cooling. Give Campbell Heating Engineers an opportunity to figure with you on your next large heating job.



MANUFACTURERS' AGENTS

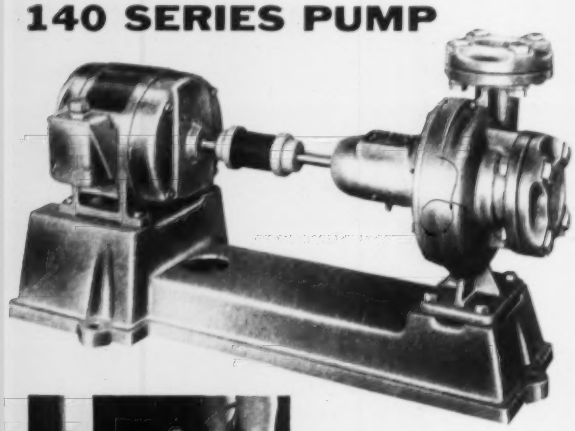
We have a number of attractive openings for manufacturers' agents who call on heating contractors and architects. If interested, please state territory you cover.

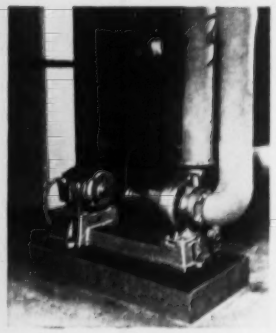
CAMPBELL HEATING CO.
Des Moines 17, Iowa
I am interested in your proposition for manufacturers' agents.
My territory covers .....
NAME .....
ADDRESS .....
CITY ..... ZONE .... STATE .....

CAMPBELL HEATING COMPANY

Des Moines 17, Iowa

NEW FROM TACO
140 SERIES PUMP





For quiet, vibrationless operation and rugged dependability on large installations

Designed specifically for heating and cooling systems requiring quiet, smooth operation, the new Taco No. 140 series pump offers a host of outstanding features:

- Water-tight, self-adjusting, self-lubricated mechanical seals.
- A motor selected for quiet operation, equipped with oil lubricated, bronze sleeve bearings.
- A spring drive coupling which easily absorbs starting torque and designed for quiet operation.
- A long-life impeller shaft of stainless steel, hardened and ground to a mirror finish.
- Bronze bearings in bracket, separated by a thrust collar attached to the shaft, absorb all end thrust.
- An oil bath circulating system with modern slinger rings, lifts oil to both bronze bearings.
- Bearing bracket, impeller and shaft are completely removable without disturbing motor, volute or piping connections.
- A closed type impeller of bronze or cast iron, dynamically balanced for smooth noiseless operation and designed to eliminate hydraulic thrust.
- Volute on body legs bolted directly to the base prevent piping strains from changing pump alignment.
- A base of cast iron designed with a three-point floor mounting to simplify leveling. Provision is also made to fill with concrete for sound deadening.

For the features that mean a better performance for every large hot water heating or cooling system, put the new Taco No. 140 series pump on the job!

Better Heating — Taco — Better with Taco

TACO HEATERS, INCORPORATED
1160 Cranston St., Cranston 9, R. I.

WHO'S WHAT — *Continued*

▶ *KRAMER TRENTON CO.* Si J. Williams, to cover Ohio and Pennsylvania area.

▶ *BRISTOL CO.* L. B. Lumpkin and W. C. Peterson, managers of Pittsburgh and Birmingham offices, respectively.

▶ *BRUNER CORP.* Edward J. Wilson, Indiana district sales representative.

▶ *GENERAL CONTROLS CO.* W. B. Harris and Joe Bustad, field representatives for Los Angeles branch; Charles V. Chapman, a similar appointment for Atlanta branch; John Sensenig, Jr., regional representative for air conditioning and refrigeration control division in Dallas factory branch; Henry L. Bryne, field representative for industrial controls division in Philadelphia branch.

▶ *INLAND STEEL PRODUCTS CO.* Francis J. Spaeth, Robert Marquardt and Charles Rosner, sales representatives for southwestern Ohio, upstate New York and northern Illinois, respectively.

▶ *GENERAL AUTOMATIC PRODUCTS CORP.* Robert I. Wooden, representative for state of Pennsylvania; Don Crawford, assistant sales manager; Casimir Wasco, representative for Illinois.

▶ *EMBASSY STEEL PRODUCTS, INC.* Irv. Peck and Jon Kass, charge of sales in Suffolk and Nassau Counties, New York.

▶ *BELL & GOSSETT CO.* District factory representatives are: Frank J. Sprague, northeastern New York; Richard Markel, New York City.

▶ *CONNOR ENGINEERING CORP.* John A. Sandberg, representative for ceiling air diffusers in Wisconsin, Minnesota, North Dakota.

▶ *CLEAVER-BROOKS CO.* R. F. McDonald Co., representative for northern half of California, western half of Nevada.

▶ *REDMOND CO.* Kris Heiberg and J. F. Pichiotino, charge of new Southeast and Midwest offices, located at Cincinnati and Oak Park, Ill., respectively. The Southwest office, Dallas, has relocated within that city. R. E. Waffle is in charge.

▶ *ORR & SEMBOWER, INC.* Sales representatives and their territories are: Boiler Supply Co., central Tennessee; Claude A. Gates Co., Westchester County, N. Y., adjacent townships in Fairfield County, Conn.; Halmar & Co., Louisville, central and western Kentucky.

How BASE-RAY helps you sell HOT WATER HEATING

NO OTHER POPULAR HEATING SYSTEM GIVES YOUR CUSTOMER ALL THESE 8 ADVANTAGES

Burnham Corporation

IRVINGTON • NEW YORK

FIRST IN THE MANUFACTURE OF BASEBOARD HEATING

1 ***Better health*** — BASE-RAY promotes better health through clean, even, draft-free winter comfort unequaled by other systems. Floor-to-ceiling temperatures vary less than 3° even in zero weather!

2 ***Low initial cost*** — In the new Series Loop System, BASE-RAY® becomes part of the main. You save 40% on pipe, 49% on installation time and 52% on fittings . . . giving your customer a high quality installation at low cost.

3 ***Greatest comfort*** — Floors are always warm . . . outer walls are blanketed with a continuous shield of radiant heat. Cold infiltration is stopped where it starts. "Living space" is increased . . . even next to large picture windows there's perfect comfort.

4 ***Complete decorating freedom*** — BASE-RAY is as inconspicuous as ordinary wood baseboard. Windows are unobstructed . . . wall-to-wall carpeting may be laid . . . there is nothing to interfere with furniture placement. It can be painted, too, to match other trim.

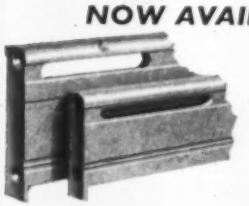
5 ***No expansion noises or "pings"*** — Thousands of BASE-RAY installations over a period of 10 years have proved its completely silent operation.

6 ***Year 'round domestic hot water*** can easily be provided at low cost with a BASE-RAY system. Every Burnham Boiler can be equipped with a special all-copper coil submerged in the hottest water at the top of the boiler.

7 ***Easier housekeeping*** — BASE-RAY provides heat that neither circulates dust nor is a source of it. No sudden air currents from open registers . . . air is circulated with utmost gentleness.

8 ***Greater long-run economy*** — Cast-iron construction means that both BASE-RAY and a Burnham Boiler, once installed, are good for a lifetime of trouble-free service. Here's the true economy that sells customers!

NOW AVAILABLE IN TWO SIZES



No. 7 (7") IBR rated at 2.35 sq. ft. per lineal foot.

No. 9 (9⅞") IBR rated at 3.45 sq. ft. per lineal foot. Used where wall space is limited or heat loss great.

Burnham Corporation HP-56
Irvington, New York

Please send me full data on BASE-RAY and copy of your new ratings and installation guide.

Name .....

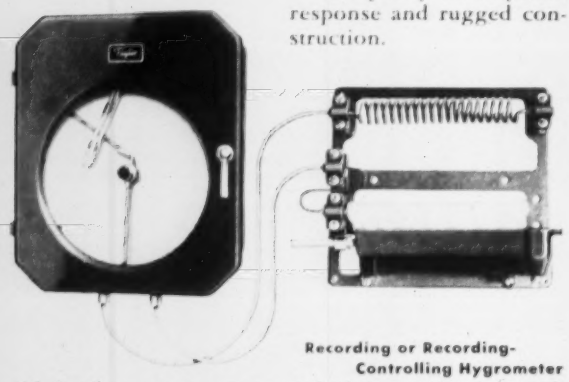
Address .....

City ..... State .....

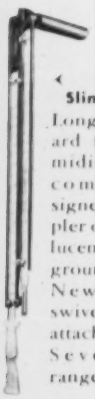
"You express yourself very well!"

TAYLOR Instruments tell the story clearly at all points where you need information or control in your heating, ventilating or air-conditioning installations.

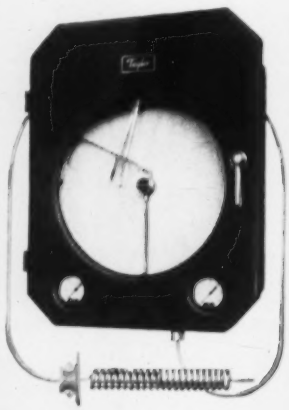
Known for accuracy and dependability, Taylor offers interchangeable control mechanisms, ease of adjustment, speedy tube system response and rugged construction.



Recording or Recording-Controlling Hygrometer with bottle or continuous water feed. For applications with good air circulation where panel is advantageously located within apparatus, room or duct for best circulation across the bulbs.



New Taylor Sling Psychrometer Long the basic standard for accurate humidity measurement, completely redesigned for even simpler operation. Translucent golden background aids reading. New-type folding swivel handle rigidly attached to metal back. Several F. and C. ranges.



Taylor FULSCOPE* Temperature Controller. Keeps lever motors, diaphragm valves, dampers, etc., in proper sequence for perfect working of your air conditioning system. Automatically compensates for load changes. Controls refrigerator compressors. Gives you automatic seasonal changeover.

Ask your Taylor Field Engineer about these instruments, or write for **Catalog 5.** Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.

*Reg. U.S. Pat. Off.

Taylor Instruments
MEAN ACCURACY FIRST

WHO'S WHAT

Continued

▸ *PENNSYLVANIA SALT MFG. CO.*—Ralph Goodwin, Peoria and Indianapolis territory expanded to include Chicago.

▸ *O. A. SUTTON CORP.*—George Emerson, responsible for air conditioner and air circulator sales in Chicago, St. Louis, Milwaukee, Minneapolis, Peoria; Howard N. Morse, a similar appointment covering Georgia, Florida, eastern Tennessee.

▸ *CAPEWELL MFG. CO.*—Fred J. Kolous, sales engineer with headquarters in Milwaukee.

▸ *COOPER ALLOY CORP.*—Reading, Pratt & Cady, in charge of building sales of stainless products through distributor outlets in the Carolinas, Georgia, Florida, Tennessee, Alabama, Mississippi.

▸ *AUTOMATIC SWITCH CO.*—Stocking distributors of solenoid valves and territories covered are: Standard Brass & Mfg. Co., Houston and Beaumont, Texas, and New Orleans, Shreveport and LaFayette, La.; Valvate-Associates, Huntington Park, Calif.; Koontz-Wagner Electric Co., Inc., South Bend, Ind.

▸ *DETROIT STOKER CO.*—John L. Bainbridge and John Dick, district managers for Cleveland and Philadelphia, respectively.

▸ *AIRTEMP DIV., CHRYSLER CORP.*—C. M. Barr, manager of new factory owned distributorship at New Orleans; R. T. Marshall, assistant regional manager for New Orleans sales district, the post previously held by Mr. Barr.

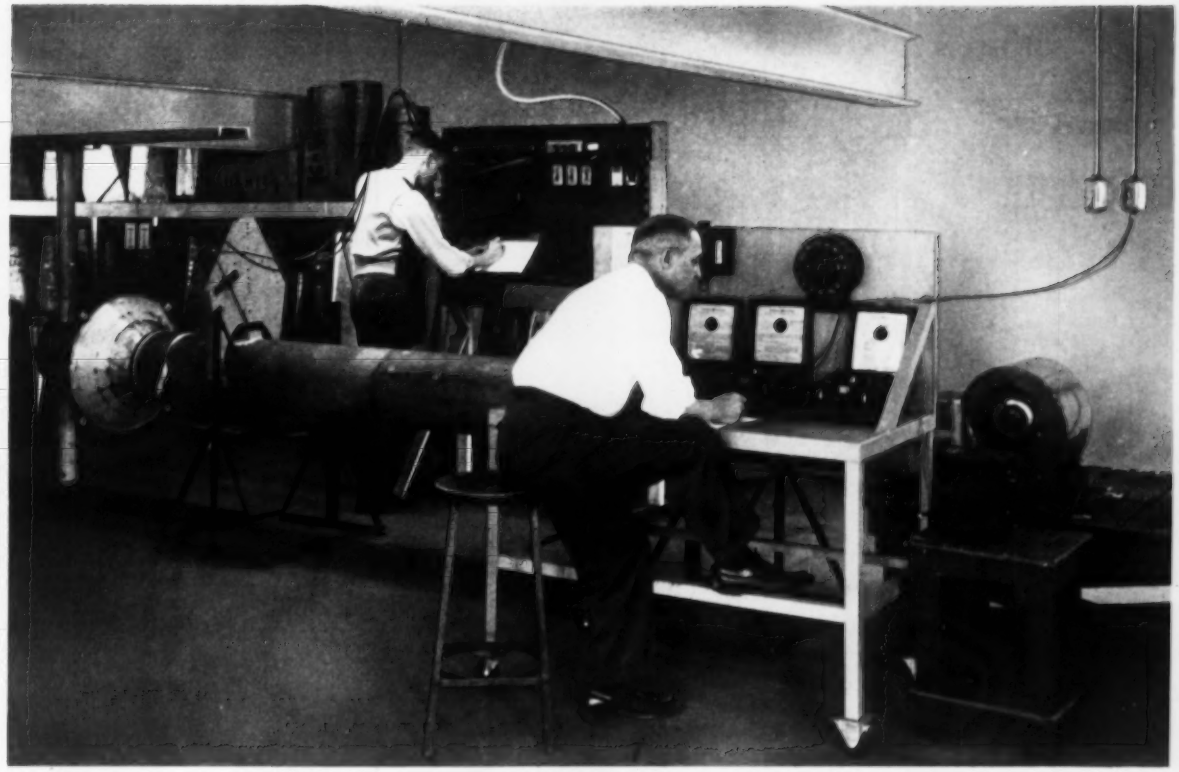
▸ *ROCKWELL MFG. CO.*—Philadelphia branch office of meter and valve division has been expanded into a district sales headquarters office with D. H. Shoemaker promoted to district sales manager.

▸ *ROBERTSHAW-FULTON CONTROLS CO.*—H. G. Klug Co., to handle sales for Fielden Instrument Div. in eastern and central Iowa.

▸ *REFRIGERATION ENGINEERING, INC.*—B. W. Embry Co., distributor for Alabama, Georgia; L. R. Gorrell, a similar appointment for the Carolinas.

▸ *A. W. CASH CO.*—Representatives and territories to be covered are: Hurston-Conaway, Inc., western Tennessee, northeastern Arkansas; Thermal Engineering Co., state of Utah.

▸ *RESEARCH PRODUCTS CORP.*—New district salesmen are: Harry J. Gilbert, Alabama, Georgia, Mississippi, part of Tennessee; Lee A. Monty, Ohio, part of West Virginia.



An expanded *Brundage* service for engineering departments and manufacturers

The terrific pace of the air conditioning and heating industry is creating formidable work loads for many engineering departments. In some cases, this causes bottle-necks . . . slowing down the marketing of profitable new products.

Brundage can help you solve this problem better than ever before.

Recent expansion has more than doubled Brundage design and testing facilities. This new capacity, combined with 55 years of experience in solving air moving problems, is at your service. If you want to put it to use on any question involving forced air, talk to your Brundage representative or contact Brundage, direct.

FREE BOOKLET,

"Blowers—and what makes them work better," gives practical installation and maintenance procedures. Write for your copy.

THE *Brundage* COMPANY
512 NORTH PARK ST.
KALAMAZOO, MICHIGAN
Telephone 2-0251

Type F

Slot STRIPLINE DIFFUSERS by AGITAIR Slot

Type S

STRIPLINE combines the best features of both slots and efficient air diffusers to provide equalized air flow throughout its entire length. STRIPLINE slot diffusers are slenderly designed, inconspicuous, practical and versatile. These slot diffusers can be located in walls, ceilings, coves, moulds, window reveals and stools or almost anywhere to suit interior design.

Type H

Write for complete Stripline Catalog.

AIR DEVICES INC. • 185 MADISON AVENUE • NEW YORK 16, N. Y. • AIR DIFFUSERS • FILTERS • EXHAUSTERS

WHO'S WHAT

Continued

▸ *OXY-CATALYST, INC.*—Representatives and the territories they will cover are: Thomas H. Danforth, western New York including Buffalo and Rochester, northwest Pennsylvania; H. O. Degner, Wisconsin, northern Illinois including Chicago, northern counties in Indiana adjacent to Chicago area; Crandall Co., southern half of Ohio including Cincinnati, Dayton.

▸ *WEBSTER ELECTRIC CO.*—Tom R. Godburn, Jr., to cover East Coast north of Baltimore.

▸ *TORK CLOCK CO., INC.*—Don Shively, sales engineer for Allied Industries, Tork's Los Angeles representative.

▸ *VIKING AIR PRODUCTS*—Nathaniel Wattles, district sales representative for Michigan, Indiana, western Ohio.

▸ *WARREN STEAM PUMP CO., INC.*—Edward W. Coburn, sales engineer with Boston office.

▸ *SUNDSTRAND MACHINE TOOL CO.*—John F. Griffey and James F. Nelson, district sales manager and sales engineer, respectively, in new Summit, N. J., office.

▸ *YORK CORP.*—Brewer I. Glenn, zone sales supervisor of company's midwest district.

▸ *WESTINGHOUSE ELECTRIC CO.*—Moore-Handley Hardware Co., distributor for ventilating sets and industrial fans in Alabama, middle Tennessee trading area, northwest Florida.

▸ *GATES ENGINEERING CO.*—Harry C. Burger, vice president of operations.

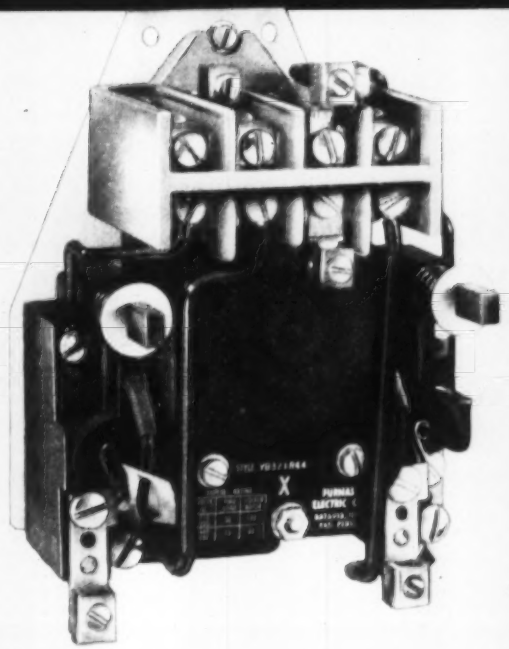
▸ *BARBER-COLMAN CO.*—John B. Moore and Edward W. Sullivan, assigned to service engineering staff at Philadelphia office; James T. Shelton and Walter Gilmore, similar assignments to Buffalo and New York offices, respectively.

▸ *MINNEAPOLIS-HONEYWELL REGULATOR CO.*—John Bain and Gordon Klossner, managers of Des Moines branch and Ft. Wayne district offices, respectively.

▸ *TUBE TURNS*—Earl R. Muir, Jr., transferred from Seattle to Louisville to become manager of newly created central district; Richard T. Burke, successor to Mr. Muir as Seattle district manager; Vernon Shallcross, representative in Denver territory; W. C. Robinson, assigned to special promotional programs and attached to Pittsburgh office. Mr. Robinson was formerly assistant sales manager of company's eastern division.

FURNAS ELECTRIC CONTROLS

do the best job for AIR CONDITIONING and REFRIGERATION



MAGNETIC CONTROLS FOR HERMETIC UNITS

As original and replacement controls for air conditioning and refrigeration units, these compact magnetic controls are available in ratings of 20, 30, 35 and 50 amperes sizes and are listed as standard by Underwriters' Laboratories. Also available is a complete line of magnetic control for open type compressor units for applications through 200 hp.

Write today for Air Conditioning Bulletin 5410, 1041 McKee Street, Batavia, Illinois.

FURNAS

FURNAS ELECTRIC COMPANY

BATAVIA, ILLINOIS

Sales Representatives in all Principal Cities

ening Dispatch
HOME EDITION
TUESDAY, NOVEMBER 29, 195
11 Narrowly Escape Death by Monoxide
Fumes Are Backed Up By Cold
THIS . . . CAN HAPPEN ANYWHERE!

LET

Quickdraft

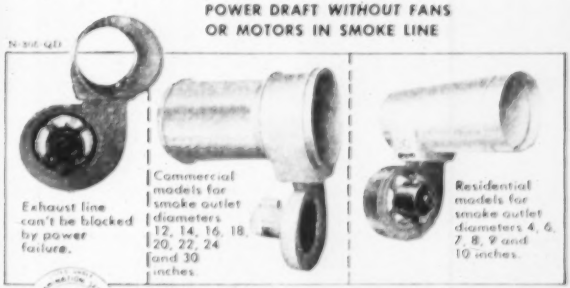
ASSURE YOU CONSTANT DRAFT FOR COMPLETE COMBUSTION

Because of natural draft troubles, more and more heating plants are operating at low efficiency and spilling combustion gasses into buildings. Intermittent firing makes it all but impossible for ordinary chimneys to handle increased volumes of heavy and cooler by-products of combustion. Better fuels produce more carbon and sulphur dioxides (CO_2 is 55% and SO_2 is 255% heavier than air). Improved furnaces and boilers let less heat escape into chimneys.

Modern fuels and heating equipment *need full and constant draft.* Turned "on" and "off" automatically with the fire, Quickdraft power draft units prevent noxious concentrations of deadly fumes and dangerous accumulations of explosive gasses from escaping into buildings.

Quickdraft cures heating-plant draft deficiencies . . . without wasting heat to "warm-up" the stack. With or without a chimney, it assures the constant draft required for burning all fuels efficiently and economically. It keeps chimneys dry and eliminates chattering, smoking and sooting. Write today for complete engineering data on the power draft unit that assures complete and economical combustion for health and safety.

POWER DRAFT *WITHOUT* FANS OR MOTORS IN SMOKE LINE


Exhaust line can't be blocked by power failure.
Commercial models for smoke outlet diameters 12, 14, 16, 18, 20, 22, 24 and 30 inches.
Residential models for smoke outlet diameters 4, 6, 7, 8, 9 and 10 inches.

UL

Quickdraft COMPANY

Dueber Hampden Bldg.
P. O. Box 87-K
Canton 1, Ohio

WE HEAR THAT...

▶ Directors of *BORG-WARNER CORP.* and *YORK CORP.* have unanimously approved the affiliation of the two companies. Borg-Warner will succeed to all of the assets and assume all of the liabilities of York in an exchange of stock. York will be operated as a separate division of Borg-Warner and is expected to continue with its present policies, management and personnel.

▶ *CRANE CO.* and *VITRO CORP. OF AMERICA* have assumed equal ownership of *HEAVY MINERALS CO.* to produce thorium, rare-earths and heavy minerals from monazite, as well as rutile, ilmenite, zircon and kyanite.

▶ *MITCHELL MFG. CO.* has introduced a new advertising service for packaged air conditioner contractors based on the principle of selling the dealer to his customers. Mitchell seeks to help establish the contractor as a reputable, effective air conditioning specialist in his community.

▶ *BABCOCK & WILCOX CO.* has installed a new twin press for bending large boiler drum half shells at its Barberton, Ohio works. The press will double the plant's plate-bending capacity, the company reports.

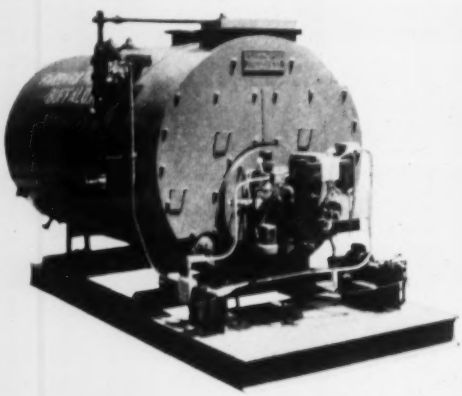
▶ *MARSHALL N. STICKEL*, sales representative for the *LUNKENHEIMER CO.* is retiring after 32 years of service to the company. His territory included New Orleans, the Gulf coast and Texas.

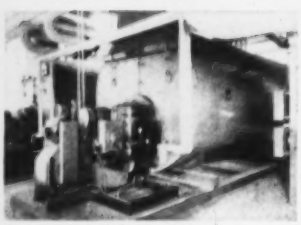
▶ The firm of *H. E. BOVAY, JR., CONSULTING ENGINEERS* is moving its Northwest office to a larger location at 933 W. Third Ave., Spokane.

▶ *WORTHINGTON CORP.*'s annual sales training program is in full swing and the meetings are being attended by approximately 90 air conditioning and refrigeration representatives from district offices. Five films on general selling techniques spark the series of lectures.

▶ *MASON-NEILAN REGULATOR CO.* has merged with *WORTHINGTON CORP.* and will be operated as the Mason-Neilan Div. of Worthington. The merger will unite two manufacturers in complementary fields — Mason-Neilan control valves and regulators, in conjunction with Worthington pumps, compressors, turbines and other types of industrial machinery.

▶ *TYPHOON AIR CONDITIONING CO.* is sponsoring several schools on service, engineering and sales designed to help its distributors increase their profits and aid servicemen in solving field problems.





Two BISON Super Scot Low-Pressure Boilers at Sylvania Electric Products, Inc., Batavia, N. Y. Engineers and General Contractors, Siegfried Construction Co., Inc., Buffalo, N. Y.; Heating Contractors, Joseph Davis, Inc., Buffalo, N. Y.

BISON

SUPER SCOT BOILERS

for packaged heating units

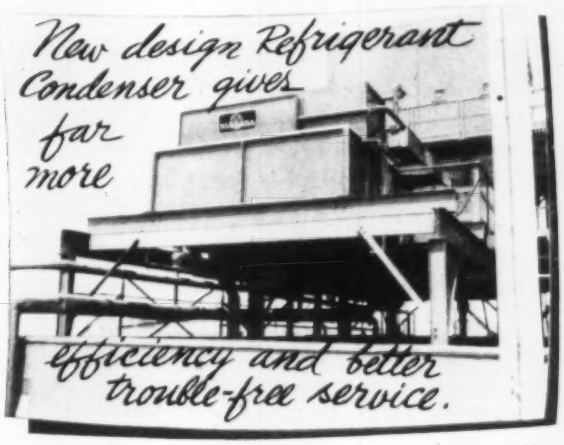
To the best in the century-old Scotch Boiler with its tried-and-true two-pass design, BISON Super Scot Low-Pressure Boilers offer a number of advantages made possible by their exclusive features.

Per unit of heating surface, Super Scot Boilers are bigger. They have a larger furnace, more steam space and water content. The area directly exposed to the radiant heat of combustion is a greater percentage of the total heating surface. Certified ratings are moderate but extra loads can be handled with larger burners.

Results — smokeless combustion, extra capacity for peak loads, lower maintenance, longer life and less cost of steam generated.

Consult F & T also for high-pressure boilers.

FARRAR & TREFTS DIVISION
ADSCO INDUSTRIES, INC.
20 MILBURN ST. BUFFALO 12, N. Y.



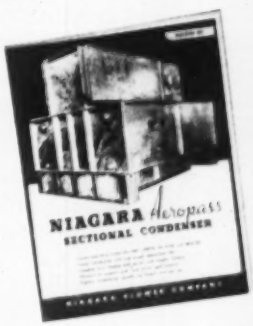
With this new, sectional design Niagara condenser you avoid the many troubles due to faulty condensing and get at all times the full capacity your refrigerating plant should afford.

You benefit from extra saving in upkeep labor and expense. The casing of this new condenser is made of sections each separately removable, giving you access to all parts for easy inspection to head off dirt and corrosion, to clean the coils easily from either side.

You benefit from greater efficiency in condensing. A simpler method of using evaporative cooling improves heat transfer. You benefit from Niagara features that remove super-heat before condensing and keep the system purged of oil. You save 95% of the cooling water cost.

You benefit from a low first cost, lower freight cost and less expense in erection.

Capacity range is from 90 to 240 tons. Write for Niagara Bulletin 131. Find out how your plant can save expense this season.

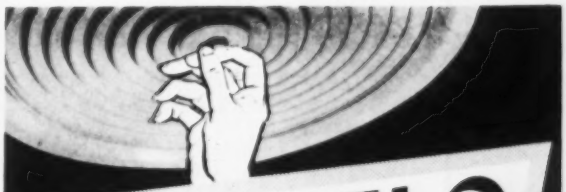


NIAGARA BLOWER COMPANY

Dept. HP, 405 Lexington Avenue
NEW YORK 17, N. Y.

District Engineers in Principal Cities

NIAGARA — *Over 40 Years' Service in Industrial Air Engineering*



FLEXIFLO

The Diffuser for Every Application

Here's the complete diffuser line with all extra features: built-in equalizing deflectors; easy to install; quick adjustment of air volume and diffusion pattern; simplified engineering; beautifully finished in any color baked enamel.

Let our sales engineers show you why Flexiflo is better for your jobs. But first — get the Flexiflo catalog.

COOLING

Type R, constant flow pattern regardless of volume adjustment.

COOLING AND HEATING

Type V, fully adjustable air diffusion pattern and volume.

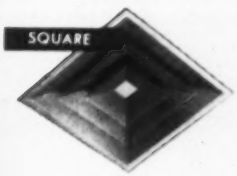
RECTANGULAR

Type MP, for 1-, 2-, 3- or 4 way diffusion to accommodate any shaped area, 16 styles.

SUPPLY AND RETURN

Type CH, adjustable for heating, ventilating and cooling.

SQUARE



Type H, adjustable volume, constant pattern and radius of diffusion.

HALF ROUND

Type S, side wall or ceiling, with Type R or V blades for heating or cooling.

Return this coupon

UNIVERSAL DIFFUSER CORP.
38 Marbledale Road, Tuckahoe, N. Y.

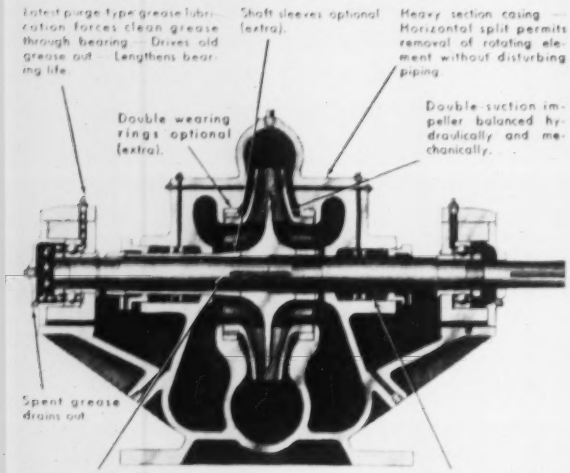
Please send me complete catalog HP

NAME

COMPANY

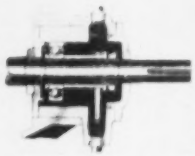
STREET

CITY ZONE STATE


Latest purge-type grease lubrication forces clean grease through bearing — Drives old grease out — Lengthens bearing life.
Shaft sleeves optional (extra).
Heavy section casing — Horizontal split permits removal of rotating element without disturbing piping.
Double wearing rings optional (extra).
Double suction impeller balanced hydraulically and mechanically.
Spent grease drains out.
Stainless steel shaft without sleeves is standard.
Extra deep stuffing boxes take either conventional packing or mechanical seals.

New Purge-type Grease Lubrication
CUTS PUMPING COSTS
on American-Marsh Type HLM and HIM Split Case Centrifugals

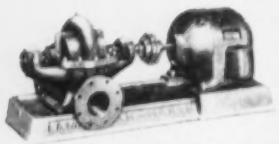
What does Purge-type Grease Lubrication offer you? Just this: By pushing out spent or dirty grease every time bearing is lubricated, it adds years of extra bearing service. That means less maintenance and longer pumping service from your total investment.



Ring-oiling ball bearings are also available (optional).

Many other superbly engineered features combine to eliminate interruptions and cut costs for A-M owners. Study the drawing a moment — You'll notice extra deep stuffing boxes and other details that are better designed, better built than ordinary pumps.

Then write for new HLM-HIM Bulletin 350, with full details and performance data.



HLM and HIM pumps are famous for low-cost service.

Pumps and Pumps only Since 1873

AMERICAN-MARSH PUMPS

BATTLE CREEK MICHIGAN

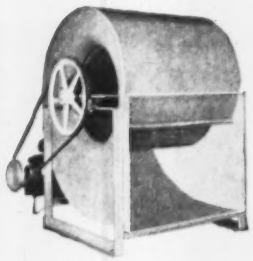
In Canada:
American Marsh Pumps (Canada) Ltd., Stratford, Ont.

CENTRIFUGAL, TURBINE, STEAM AND POWER PUMPS FOR TESTING, PROCESSING, BOILER FEED, FIRE PROTECTION, ETC

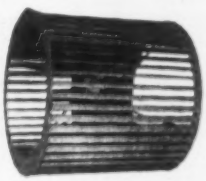
Cut your costs with BARRY
Industrial
BLOWERS — BLOWER WHEELS — HOUSINGS
MULTIPLE BLOWER ASSEMBLIES

Yes, you can save because BARRY blowers usually cost you less, yet you get highest quality materials and workmanship . . . and deliveries are surprisingly fast!

BARRY blower wheels are precision made from either steel, stainless steel, copper, brass or aluminum, and are expertly balanced and trued. Many of the country's leading heating, air conditioning and ventilating equipment manufacturers use BARRY blowers, or blower wheels and housings because they have found BARRY a dependable, low cost source of supply.



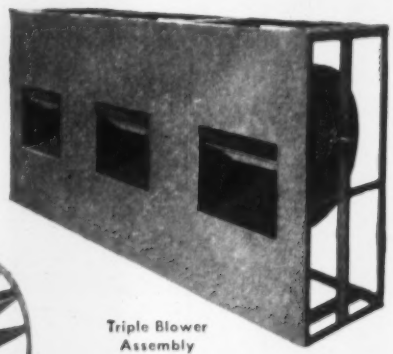
Double Inlet Blower



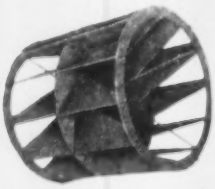
Double Inlet Forwardly Curved Wheel

● **Built to YOUR OWN Specifications!**

Single Inlet Backwardly Curved Wheel

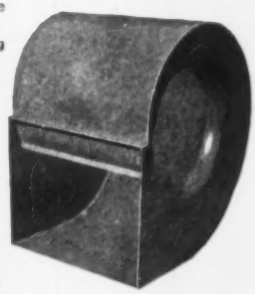


Triple Blower Assembly



Double Inlet Backwardly Curved Wheel

Double Inlet Housing



INVESTIGATE for your own requirements. Send us your specifications for prompt, no-obligation quotation.

BARRY BLOWER CO.

3100 California St., N. E.
MINNEAPOLIS 18, MINNESOTA

WE HEAR THAT

Continued

▶ *CRANE CO.* is bringing a rolling exhibit called "Schoolroom Progress, U. S. A." to millions of Americans to show the need for more and better education facilities. The two car, rail exhibit shows the school of yesterday, the school of today, and the school of tomorrow.

▶ *AIRMATIC VALVE, INC.* is expanding its facilities with its move to a location at 7313 Associate Ave., Cleveland. The move will triple Airmatic's present facilities, company officials report.

▶ *MELLON INSTITUTE OF INDUSTRIAL RESEARCH* gave a testimonial dinner in honor of retiring president, *DR. EDWARD R. WEIDLEIN*. Dr. Weidlein will continue to serve Mellon as a member of the board of trustees and in an advisory capacity.

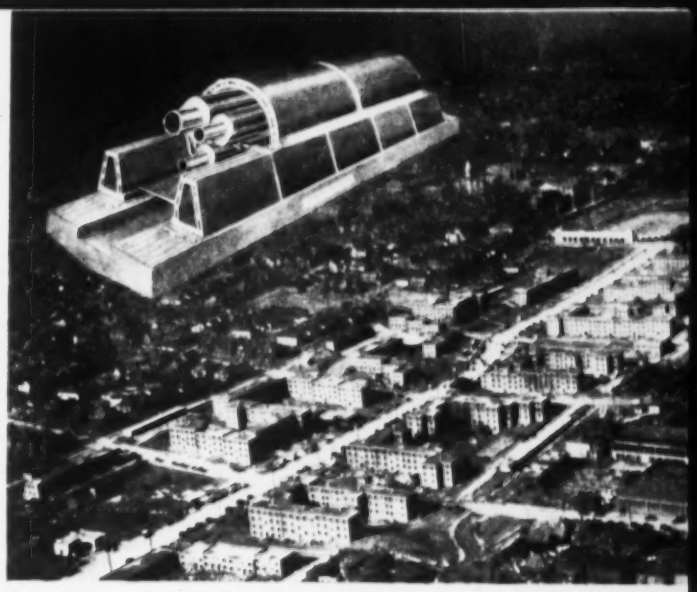
▶ *TRANE CO.* has awarded contracts for the construction of a new engineering office building. Cost of the structure has been set at $1,250,000. Construction of the 65,000 sq ft building is underway and completion is expected by February 1957.

▶ *AMERICAN AIR FILTER CO., INC.* has introduced a new pocket-sized calendar, "dollar diary," which is designed to help management explain the company's operations to employees. The diary graphically illustrates the number of work days necessary last year to provide income to pay the company's expenses.

▶ *AMERICAN-MARIETTA CO.* has bought the entire assets and business of the *PRESSTITE ENGINEERING CO.* Presstite will be operated as an American-Marietta division under *CYRIL H. SMITH*, president, and his associates.

▶ *BITUMINOUS COAL RESEARCH, INC.* held its third "Techno-Sales" conference and its annual meeting of members at Columbus, Ohio, recently.

▶ *WATER SERVICE LABORATORIES, INC.* is holding a corrosion research exhibit which provides examples of short term serious damage to vital components, taken from comfort cooling facilities actually in use in the field. The exhibit includes continuously operating simulated air conditioning systems which provide visual evidence of the effects of treated and untreated water on metal parts and piping commonly used in cooling equipment.



20 YEARS AGO

Therm-O-Tile

REG. U.S. PAT. OFF.

UNDERGROUND PIPE CONDUIT

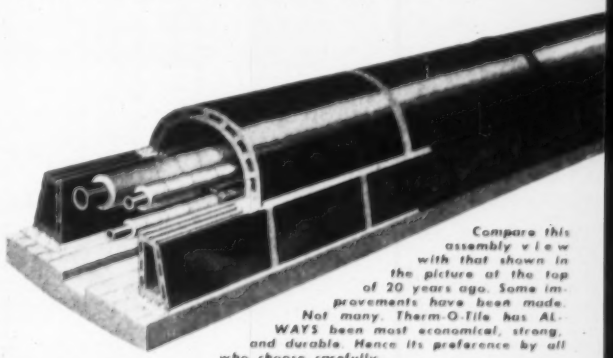
The picture at the top appeared in the June 1936 issue of HEATING, PIPING & AIR CONDITIONING. At that time we were not aware of its importance ourselves for it was the

First Federal Housing Project and Therm-O-Tile Underground Pipe Conduit was Specified.

During these twenty years Therm-O-Tile has been specified for many more Federal and other Housing Projects, all over the United States, requiring many miles of Therm-O-Tile. 6,000 feet was used in the FIRST project, at Atlanta, Ga., to supply heat to 700 families.

Ask for Advice. Our engineers, specialists in underground conduit design, will gladly work with you without obligation to develop the best and most economical installation for your purpose.

Bulletin 10154. This bulletin, recently published, gives all of the important data concerning Therm-O-Tile. Ask for a copy.



Compare this assembly view with that shown in the picture at the top of 20 years ago. Some improvements have been made. Not many. Therm-O-Tile has ALWAYS been most economical, strong, and durable. Hence its preference by all who choose carefully.

H. W. PORTER & CO., INC.

822-H Frelinghuysen Avenue • Newark 5, N. J.

REID HAYDEN, INC.

BALTIMORE, MD. RICHMOND, VA. CHARLOTTE, N. C.

Insulation Engineers & Contractors

WEBSTER

Research

Engineering

Design

Manufacturing

Sales

Service

- - - All are available through Webster's Service and Sales organization. Offices are located throughout the country.

It has always been the policy of Webster to make personal contact on every job — a Webster Combustion Installation must be satisfactory.

The engineering service departments of Webster and its exclusive agents would welcome the opportunity to help solve your combustion problems, to make recommendations and quotations.

Webster equipment is marketed through @JANITROL district offices and many other exclusive agents.

The
WEBSTER ENGINEERING *Company*
TULSA 1, OKLAHOMA

Division of SURFACE COMBUSTION CORPORATION, Toledo, Ohio

WE HEAR THAT

Continued

▸ *AIR MOVING AND CONDITIONING ASSOCIATION, INC.* reports an 8 percent increase in 1955 on the sale of air moving and conditioning devices. Another increase of 8 percent in 1956 is forecast by the association.

▸ *PERFECTION INDUSTRIES*, a division of *HUPP CORP.*, is to purchase the business and assets of *GIBSON REFRIGERATOR CO.* A meeting of stockholders was held on April 25 to approve the agreement.

▸ *AIRTEMP DIV.*, of *CHRYSLER CORP.*'s Nashville distributor, *CENTRAL DISTRIBUTORS*, has announced plans for the construction of a new $100,000 plant in that city. The new building will have 11,000 sq ft of floor space, with provisions for addition of 3000 more in about 18 months.

▸ A new source of supply for galvanized sheets has been announced by *JONES & LAUGHLIN STEEL CORP.* with the start of production of its new $6,250,000 continuous hot-dip galvanizing line. The line has a rated capacity of 7000 to 8000 tons a month, the company reports.

▸ *NATIONAL HEATER CO.* will build a new $250,000 plant this spring in St. Paul. Construction began early in April on the 36,000 sq ft plant, which is located on a 6 acre tract.

▸ Among the officers elected at the recently held fourth annual meeting of the *REFRIGERATION TRADE ASSOCIATION OF AMERICA* are *L. L. CARTER*, president; *SIDNEY BLOOM*, first vice president; *J. B. BROUGHTON*, second vice president; *O. MANLEY SMITH*, secretary; *LEO WOLFF*, treasurer. Those elected will assume office July 1.

▸ *AMERICAN ZINC INSTITUTE* has prepared a new 16 mm color and sound motion picture film entitled "Zinc Controls Corrosion." It covers the part that zinc plays in preventing corrosion and goes on to explain the galvanic process. The film is to be made available without charge from the institute, which is located at 60 E. 42nd St., New York 17.

▸ *LOCKWOOD, ANDREWS & NEWNAM* is the new name of the firm *LOCKWOOD & ANDREWS, CONSULTING ENGINEERS*. The offices have been moved to 1010 Waugh Drive, P. O. Box 13 332, Houston.

WE HEAR THAT

Continued

▶ *BALLINGER-MESEROLE CO.*, Philadelphia, has been retained to design the layout and operation of a 200,000 sq ft distributing warehouse for *MINNEAPOLIS-HONEYWELL REGULATOR CO.*, in the Minneapolis area.

▶ *BUSH MFG. CO.* has erected two new warehouses, one of 35,000 sq ft in West Hartford, Conn., another of 5000 sq ft in Riverside, Calif. The two additions will free manufacturing space which can be devoted exclusively to production. In conjunction with *HEAT-X, INC.*, Bush has established warehouses in Chicago, Kansas City and Atlanta to facilitate prompt delivery and service.

▶ *INTERNATIONAL NICKEL CO., INC.*'s St. Louis office of its technical field section is now located at 10 South Brentwood Blvd., St. Louis 5.

▶ *CHASE BRASS & COPPER CO., INC.* is moving its Kansas City office and warehouse to 1710 Washington Street. The new warehouse will give Chase almost twice its former area, company officials state. *P. D. EVANS* continues as district manager at the new location.

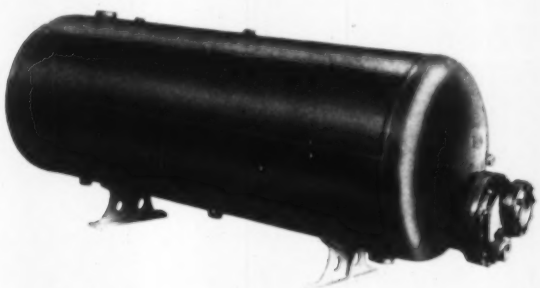
▶ *THOR POWER TOOL CO.* has formed a construction equipment division and will begin activities at once. *WILLIAM J. MILLER* and *ELMER R. STITT* will head the new division. *W. C. NUSSBAUM* and *PAUL DEVOE* will be in charge of new product design and development.

▶ The *M. B. KELLOGG CO.* is moving its offices to a new building at 711 Third Ave., New York. Pullman Inc., Kellogg's parent company, will also have offices in the new building, as will another Pullman subsidiary.

▶ *PREMIER CO.* has added facilities designed to permit increased production for vacuum units and specialized tools and tool kits for heating and air conditioning maintenance cleaning work.

▶ *BETTER HEATING-COOLING COUNCIL* has started to inform and educate the public, the trade, and the building industry about the advances and advantages of all types of water-fed heating and cooling systems for small buildings. The council is also staging a drive for additional members and funds needed to mount a campaign budgeted at $250,000 annually.

Select the Whitlock Storage Heater to Fit Your Needs



STANDARD STEEL SHELL . . . low cost . . . designed for average installations where low corrosion rates are encountered.

KONKRETE-LINED STEEL SHELL . . . provides low cost protection against corrosion or pitting.

SILICON BRONZE SHELL . . . your best investment for installation where water is actively corrosive to steel. Provides lifetime service.

Whitlock Type K Storage Heaters furnish an adequate supply of clean, hot water at lowest possible cost. They can be provided in various constructions in Horizontal or Vertical models. Our engineers will gladly discuss with you the unit best suited to your requirements. See your local Whitlock Representative or write for Bulletin 40B.

Whitlock

Designers and builders of bends, coils, condensers, coolers, heat exchangers, heaters, piping, pressure vessels, receivers, reboilers.

THE WHITLOCK MANUFACTURING CO.
WEST HARTFORD 10, CONN

• Please send Bulletin 40B describing Whitlock Type K Storage Heaters.

Name

Company

Address

WE HEAR THAT

Continued

▸ *COLEMAN CO., INC.*, held a series of seven regional training sessions for utility engineering and service personnel directly interested in gas air conditioning. The Lone Star Gas Co., Dallas; Oklahoma Natural Gas Co., Tulsa; Atlanta Gas Light Co., Atlanta; Ohio Fuel Gas Co., Columbus, Southern California Gas Co., Los Angeles; Brooklyn Union Gas Co., Brooklyn; and Iowa Power and Light Co., Des Moines; cooperated with the Coleman in staging the training schools.

▸ *JOSEPH E. BIRO AND ASSOCIATES*, consulting engineers, has moved its offices to larger quarters at 500 Bushkill Drive, Easton, Pa.

▸ *H. N. HARTWELL & SON, INC.*, and *BOLTA PRODUCTS*, a division of the *GENERAL TIRE & RUBBER CO.*, have established the *PLASTIC FABRICATING INSTITUTE* at Lawrence, Mass. The Institute was set up to train fabricators, distributors, piping contractors and industry in the application, fabrication, welding and forming of unplasticized polyvinyl chloride materials.

▸ *WESTINGHOUSE ELECTRIC CORP.* plans to build the first industry-owned, nuclear materials testing reactor near Waltz Mill, Pa., instead of at Blairsville, Pa., as previously announced. The full-scale testing reactor will operate in the range of 20,000 kw or above and will be used to test materials under conditions similar to a power reactor.

▸ *PENN CONTROLS, INC.* will tour the eastern states this spring with "Controlorama," an educational road show on automatic controls for heating, air conditioning, and refrigeration. Controlorama uses "live" heating, refrigeration and air conditioning systems operating panels which simulate actual operating conditions under various types of control situations.

▸ *U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE* is having a continuing, annotated bibliography on air pollution prepared by the Library of Congress. The bibliography will include references to the physical, biological, engineering, legal-administrative, and economic aspects of atmospheric pollution.

▸ *BLACK & DECKER* has opened two service branches, one relocated in Pittsburgh and one new one in Columbus. The addition of the Columbus branch increased the number of service stations to 39.

Shhhhh . . .

COMPLETE *SILENCE*
FOR YOUR ENTIRE
PIPING SYSTEM
WITH A

MILLER *STREAMFLOW* CHECK VALVE

CENTER GUIDED • SHOCK PROOF • ELIMINATES WATER HAMMER
ENTIRELY *NOISELESS* • FULL RADIAL FLOW
Certified Minimum Pressure Loss Curves Available • Sizes 1" through 24"
Flanged • ASA Drilling • IBBM • Cast Steel • All Alloys

Visit our Booth 1118 International Amphitheater, Chicago, Illinois International Exposition February 25 — March 1, 1957

WRITE FOR LATEST CATALOG
AGENTS IN PRINCIPAL CITIES

MILLER VALVE CO. INC.

P.O. BOX 1255 — PITTSBURGH 30, PA.
PLANT — 1620 PENNSYLANIA AVE.

One of three Goulds Fig. 3750 pumps circulating chilled water in air conditioning system in big color processing building of Eastman Kodak Company, Rochester, N. Y.

They help keep roses red and violets blue

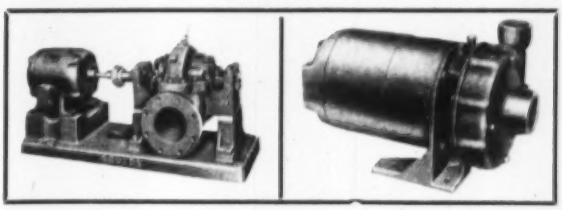
Processing color photographs requires extremely close control of temperature at all stages.

In the big color film and print processing building in Kodak Park, in Rochester, N. Y., three Goulds pumps like the one shown above help maintain the correct temperature by circulating 50° water through heat exchangers serving process work rooms.

The critical nature of the process means that these pumps must stay on the job 24 hours a day—day in and day out—and these Goulds pumps have been doing just that for the last two years.

You can insure the same kind of dependable pump performance in your air conditioning installations, too, by specifying Goulds pumps. There's a Goulds pump for every liquid handling job—designed from the experience gained over a century of pump manufacture, and ruggedly built to give long, trouble free service.

Your Goulds representative will be glad to help you select the right pumps to fit your requirements. If you prefer to write directly to our main office, your inquiry will receive prompt attention.



Goulds Fig. 3405 double suction pump offers many advantages for larger installations. Available in 19 sizes, providing capacities up to 6,400 GPM, heads to 260 ft. For full details write for Bulletin 721.6.

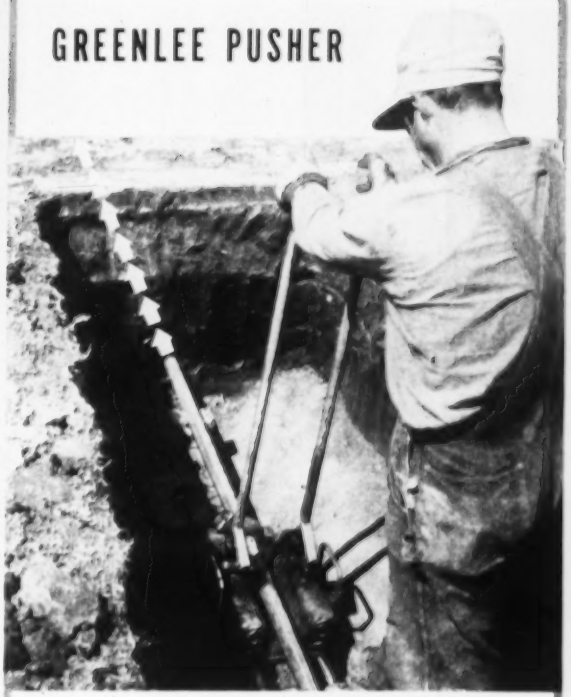
Goulds popular "close-coupld" Fig. 3642 and Fig. 3643 pumps provide compact efficiency, simplicity in small installations. In sizes from ¼ to 5 HP. Capacities up to 175 GPM, and heads to 140 ft. For additional details write for Bulletin 624-A.3.

MEMBER HYDRAULIC INSTITUTE

Goulds PUMPS INC.
Seneca Falls New York

Atlanta • Boston • Chicago • Houston • New York • Philadelphia • Pittsburgh • Tulsa

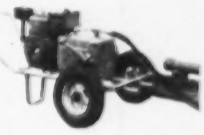
CUT COSTS ON UNDERGROUND PIPING INSTALLATIONS WITH GREENLEE PUSHER



Save hours of time, cut job costs with this quick, easy way of installing underground pipe. With a GREENLEE Hydraulic Pipe Pusher, *one man* pushes pipe *under* streets, walks, tracks, lawns, floors, and other obstacles. No costly tearing up of paving . . . eliminates extensive ditching, as just a short trench accommodates the Pusher. No tedious tunneling, backfilling, tamping, repaving. Compact, portable, powerful. Often pays for itself on first few jobs. Thousands in use for big savings of time and labor. Two models: one for ¼ to 4" pipe, one for larger pipe, concrete sewer pipe, drainage ducts. Write for facts today.

POWER PUMP

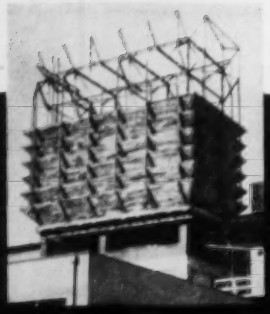
For all models of GREENLEE Pipe Pushers and Hydraulic Pipe Benders. Makes the toughest pushing jobs simple, fast. Average pushing performance 100 feet per minute. Rubber-shielded rubber carriage, available as extra equipment, provides convenient, easy way to transport and move about on job location.



TOOLS FOR CRAFTSMEN

GREENLEE

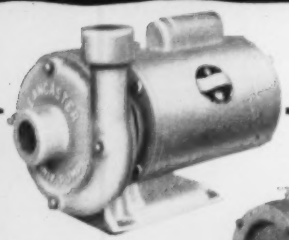
Greenlee timesaving tools for plumbing and heating work: Hydraulic Pipe Pushers • Hydraulic Pipe Benders • Tubing Benders • Pipe Bits Auger Bits • Spiral Screw Drivers • Chisels • And many more Greenlee Tool Co., 2345 Twelfth Street, Rockford, Illinois

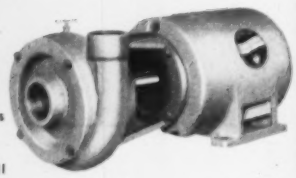


For All Air Conditioning and Refrigeration Installations

LANCASTER UNIT PUMPS TYPE M

Low Cost, High Quality Close-Coupled Centrifugal Pumps





- Quiet Operation
- Balanced Bronze Impellers
- Bronze Shaft Coupling
- Easy to Install
- Four Position Indexing
- Ceramic Seat Mechanical Seals

LANCASTER Unit Pumps Type M are specifically designed for Air Conditioning and Refrigeration systems wherever a reliable and dependable close-coupled Centrifugal Pump is required. They are ideal for cooling tower systems as well as brine and other liquid circulation.

All LANCASTER Unit Pumps are designed for continuous duty and are equipped with the latest type ceramic seat seals. Heavy duty models are available from $\frac{1}{3}$ to $7\frac{1}{2}$ HP. They are also well suited for general purpose industrial applications.

You can use Submersibles for modern and convenient deep well cooling in your air conditioning systems. Be sure to find out about the complete line of LANCASTER Underwater Pumps from $\frac{1}{3}$ HP to 275 HP equipped with reliable 100% water cooled, water lubricated, and water filled motors.

Write for latest catalog.

LANCASTER pumps

LANCASTER PUMP & MANUFACTURING CO., Inc.

Box J-778, Lancaster, Pa.

WE HEAR THAT

Continued

▶ *COMMERCIAL FILTERS CORP.* has merged with *HONAN-CRANE* and *MICHIANA* to form a new subsidiary, *INDIANA COMMERCIAL FILTERS CORP.* The Honan-Crane and Michiana filter lines will be retained under their present names, while a new brand name, "CFC" will identify filtering and conveying equipment formerly known as "Houdaille".

▶ *VIKING AIR PRODUCTS* plans to establish a manufacturing branch for blower wheels and assemblies in the Southwest. Several sites are under consideration for 60,000 sq ft of manufacturing plant space to serve growing air conditioning, evaporative cooler, and cooling tower markets in the Texas-Oklahoma-Kansas area.

▶ *GENERAL CONTROLS CO.* has begun construction on a new 5000 sq ft building in San Francisco. The larger quarters will make it possible for General Controls to display and deliver more of its products in that area, the company reports.

▶ *SHERRILL-NOONAN, INC.* is building a 130,000 sq ft factory for lease to *IRON FIREMAN MFG. CO.* at Ligonier, Indiana.

▶ Fourteen different fire training courses will be conducted by *ANSUL CHEMICAL COMPANY* during 1956 on their 10 acre fire test field. Company instructors will teach the latest techniques in fire extinguishment to representatives of industry, government and the municipal fire-fighting services during each of the three day courses.

▶ *ORANGEBURG MFG. CO.*, has commenced work on a plastic pipe plant adjoining its Orangeburg, N.Y. plant. Completion is scheduled for July.

▶ *AIRTEMP DIV., CHRYSLER CORP.* is holding two one-week conferences for company field engineers in Dayton to review the air conditioning products produced by Airtemp, proposed new products and to familiarize meeting participants with recent developments in the field of air conditioning engineering and application.

▶ *CULLIGAN, INC.* is building a new addition to the company's plant in Northbrook, Ill., that will increase floor space by 40,000 sq ft and permit a 60 percent boost in production, according to the company. With the addition, the plant will have more than 120,000 sq ft of floor space. ≠

MEETINGS & CONVENTIONS

MAY 9-10—*National Association of Corrosion Engineers*, northeast region meeting. University of Buffalo. NACE headquarters: 1061 M & M Bldg., Houston 2, Texas.

MAY 9-11—*Fourth Welding Show*. Memorial Auditorium, Buffalo. Sponsored by American Welding Society, 33 W. 39th St., New York 18.

MAY 9-12—*Sheet Metal Contractors' National Association, Inc.*, annual convention. Shoreham Hotel, Washington, D.C. J. D. Wilder, executive secretary, 170 Division St., Elgin, Ill.

MAY 11-12—*Michigan Engineering Society*, 70th annual convention. Pantlind Hotel, Grand Rapids. Information: D. B. Apted, 945 San Lucia Dr., Grand Rapids, Mich.

MAY 14-15—*Steel Boiler Institute*, annual meeting. Brown Hotel, Louisville. SBI headquarters: 1308 Land Title Bldg., Philadelphia 10.

MAY 14-16—*Commercial-Industrial Oil Burning and Equipment Workshop*. Kellogg Center, Michigan State University. Sponsored by Oil-Heat Institute of America, Inc. Information: Department of Mechanical Engineering, Michigan State University, East Lansing, Mich.

MAY 14-17—*American Society of Mechanical Engineers*, conference to coincide with First Design Engineering Show, Convention Hall, Philadelphia. Show sponsored by Clapp & Poliak, Inc., 341 Madison Ave., New York 17. ASME headquarters: 29 W. 39th St., New York.

MAY 15-16—*Industrial Nuclear Technology Conference*. Museum of Science and Industry, Chicago. Information: Armour Research Foundation of Illinois Institute of Technology, 35 W. 33rd St., Chicago 16.

MAY 15-18—*Heating, Piping and Air Conditioning Contractors National Association*, annual meeting. Kentucky Hotel, Louisville. HPACCNA headquarters: 30 Rockefeller Plaza, New York 20.

MAY 20-22—*Building Research Institute*, fifth annual meeting. Sheraton-Brock Hotel, Niagara Falls, Ontario. BRI headquarters: 2101 Constitution Ave., Washington 25, D.C.

MAY 20-23—*Industrial Heating Equipment Association, Inc.*, spring meeting. The Homestead, Hot Springs, Va.

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Three highly important facts were behind the Lexington's decision to install International. First: the unit's whisper-quiet operation assures complete guest satisfaction. Second: expensive, inconvenient installation of ductwork is eliminated. Third: maintenance requirements are at a minimum.

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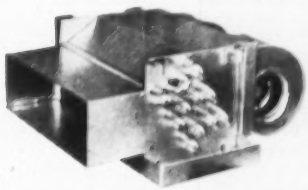

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MEETINGS & CONVENTIONS

Continued

MAY 20-24—Air Pollution Control Association, Niagara Frontier annual meeting. Hotel Statler, Buffalo. Information: Harry C. Ballman, executive secretary, APCA, 4400 Fifth Ave., Pittsburgh 13.

MAY 22-25—National Warm Air Heating and Air Conditioning Association, board of trustees and committee meetings and technical conference. Edgewater Beach Hotel, Chicago. The Association is at 640 Engineers Bldg., Cleveland 14.

JUNE 4-6—American Society of Refrigerating Engineers, summer annual meeting. Cincinnati. ASRE headquarters: 234 Fifth Ave., New York 1.

JUNE 4-7—National District Heating Association, 47th annual meeting. Inn and Lodge, Williamsburg, Va. John F. Collins, Jr., secretary-treasurer, NDHA, 827 N. Euclid Ave., Pittsburgh.

JUNE 4-8—National Fire Protection Association, annual meeting. Hotel Statler, Boston. The association is at 60 Batterymarch St., Boston.

JUNE 11-15—Electrostatic Precipitation Seminar. Pennsylvania State University. Chairman: R. E. Arrington, assistant professor of electrical engineering, Pennsylvania State University, University Park, Pa.

JUNE 11-15—21st National Oil-Heat Show. Coliseum, New York. Managing director: R. H. L. Becker, Oil-Heat Institute of America, Inc., 500 Fifth Ave., New York 36.

JUNE 11-15—Seventh National Plastics Exposition. Coliseum, New York. Society of the Plastics Industry, Inc., 67 W. 44th St., New York 36.

JUNE 17-22—American Society for Testing Materials. Chalfonte-Haddon Hall, Atlantic City. ASTM headquarters: 1916 Race St., Philadelphia 3.

JUNE 18-20—American Society of Heating and Air-Conditioning Engineers, Inc., semi-annual meeting. Shoreham Hotel, Washington, D.C. ASHAE headquarters: 62 Worth St., New York 13.

JUNE 17-21—American Society of Mechanical Engineers, semi-annual meeting. Statler Hotel, Cleveland. Headquarters: 29 W. 39th St., New York 18.

JUNE 21-23—1956 Heat Transfer and Fluid Mechanics Institute. Stanford University. General chairman: S. J. Kline, Mechanical Engineering Department, Stanford University, Stanford, Calif.

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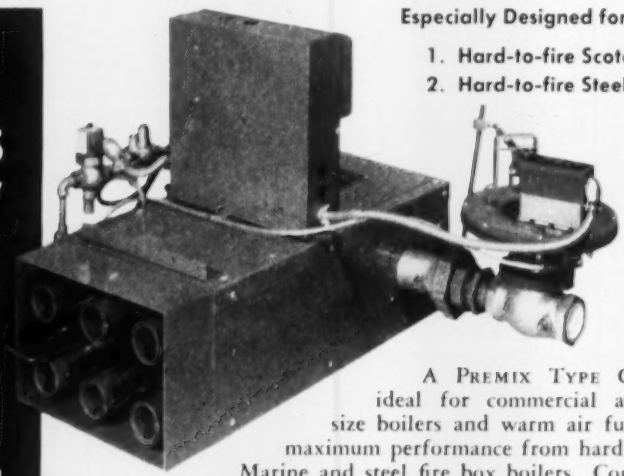

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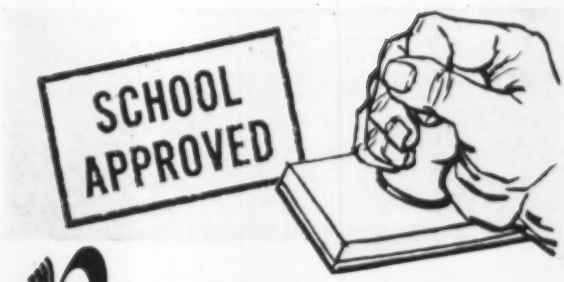

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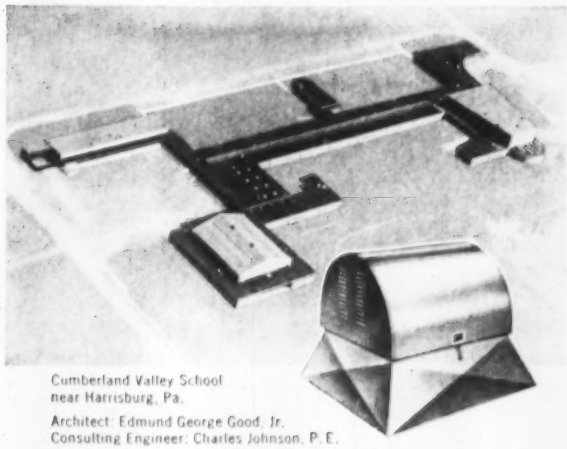

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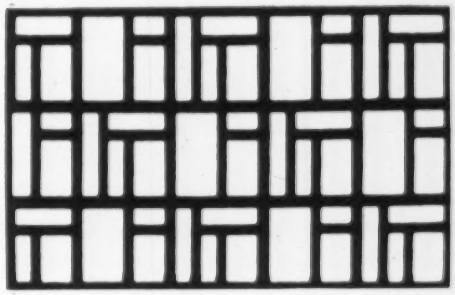

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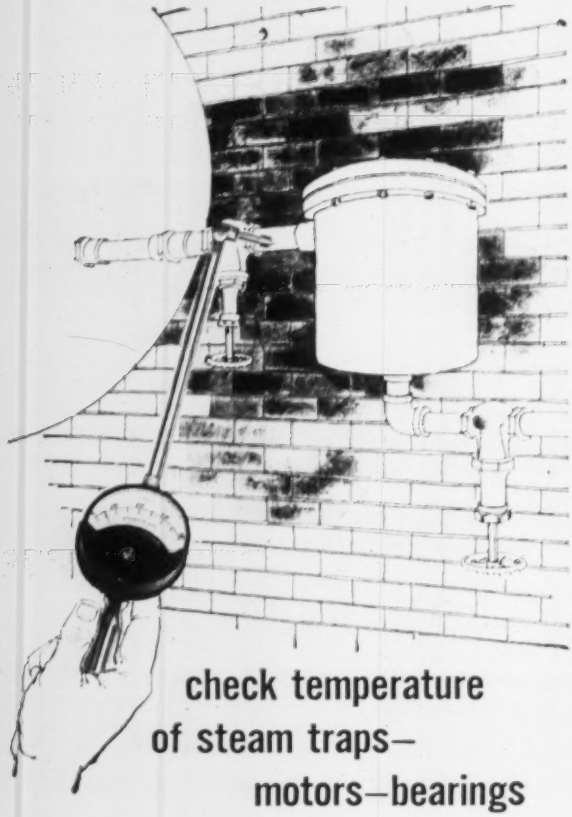

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MEETINGS & CONVENTIONS — *Continued*

JUNE 25-29—*American Society for Engineering Education*, annual meeting. Iowa State College, Ames. Secretary: W. Leighton Collins, University of Illinois, Urbana.

JUNE 26—*Thermoplastic Structures Div. of the Society of the Plastics Industry*. Roosevelt Hotel, New York. Information: Society of the Plastics Industry, Inc., 67 W. 44th St., New York 36.

SEPT. 10-12—*The American Society of Mechanical Engineers*, fall meeting. Denver. ASME headquarters: 29 W. 39th St., New York 18.

SEPT. 17-21—*11th Annual Instrument-Automation Conference and Exhibit*. Coliseum, Columbia University, and Hotels Statler and New Yorker, New York. Sponsored by Instrument Society of America. Exhibit office: 250 W. 57th St., New York.

SEPT. 24-28—*Trade Fair of the Atomic Industry*. Navy Pier, Chicago. Conference Headquarters, Morrison Hotel, Chicago. Information: Dan Scherer, Atomic Industrial Forum, Inc., 260 Madison Ave., New York 16.

SEPT. 25-27—*Third Annual Forum Conference*, "Management and Technology for the Atomic Industry". Morrison Hotel, Chicago. Information: D. J. Scherer, Atomic Industry Forum, 260 Madison Ave., New York 16.

OCT. 1-3—*Heating, Piping and Air Conditioning Contractors National Association*, fall board of directors meeting and secretaries' conference. Hotel Statler, Detroit, Michigan. Headquarters: Room 210, Shoreham Bldg., Washington 5, D.C.

OCT. 1-5—*National Association of Corrosion Engineers*, south central regional meeting. San Antonio. NACE headquarters: 1061 M & M Bldg., Houston 2, Texas.

OCT. 8-12—*American Welding Society*, fall technical meeting. Hotel Cleveland, Cleveland. Headquarters: 33 W. 39th St., New York 18.

Week of OCT. 12—*American Gas Association*, annual convention. Atlantic City. AGA headquarters: 420 Lexington Ave., New York 17.

OCT. 22-24—*American Standards Association*, 38th annual meeting in conjunction with Seventh National Conference on Standards. Hotel Roosevelt, New York, N.Y. Headquarters: 70 E. 45th St., New York, N.Y.

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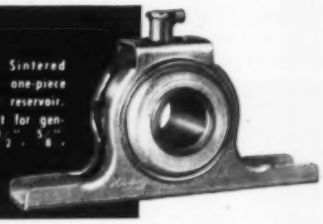

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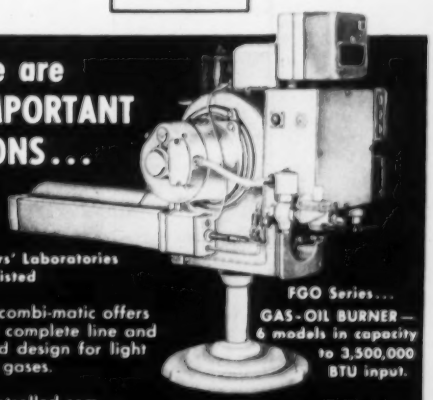

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MEETINGS & CONVENTIONS — *Continued*

OCT. 22-26—44th National Safety Congress & Exposition. Chicago. National Safety Council, 425 N. Michigan Ave., Chicago 11.

OCT. 24-27—Air-Conditioning and Refrigeration Wholesalers, annual meeting. Jung Hotel, New Orleans. Headquarters: 2607 N. High St., Columbus, Ohio.

NOV. 15-18—Refrigeration Service Engineers Society, annual convention. Kansas City, Mo. Headquarters: 433 N. Waller Ave., Chicago 44.

NOV. 25-28—American Society of Refrigerating Engineers, semi-annual meeting. Boston. Information: ASRE, 234 Fifth Ave., New York 1.

NOV. 25-30—American Society of Mechanical Engineers, annual meeting. Statler Hotel, New York. ASME headquarters: 29 W. 39th St., New York 1.

NOV. 26-30—22nd National Exposition of Power and Mechanical Engineering. Coliseum, New York. Under auspices of American Society of Mechanical Engineers. Manager: E. K. Stevens, care of the Exposition, 130 Lexington Ave., New York 17.

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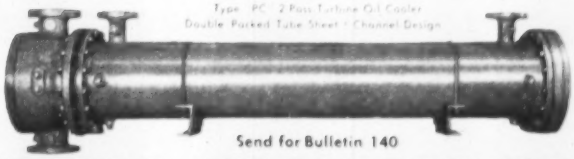

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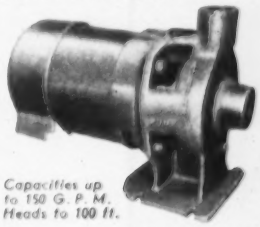

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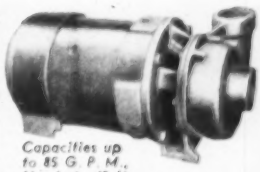

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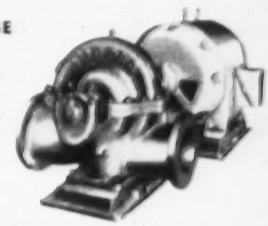

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MEETINGS & CONVENTIONS — *Continued*

NOV. 26-30—Third International Automation Exposition. Trade Show Bldg., New York. Management: Richard Rimbach Assoc., Inc., 815 Ridge Ave., Pittsburgh 12.

NOV. 27-30—National Warm Air Heating and Air Conditioning Association, committee meetings and annual convention, Conrad Hilton Hotel, Chicago. NWAHACA headquarters, 640 Engineers Bldg., Cleveland 14.

NOV. 27-30—Ninth National Chemical Exposition. Public Auditorium, Cleveland. Chicago Section of the American Chemical Society, 36 E. Randolph St., Chicago 1.

FEB. 25-MAR. 1, 1957—International Heating & Air-Conditioning Exposition. International Amphitheater, Chicago. Under auspices of American Society of Heating and Air-Conditioning Engineers, in conjunction with its 63rd annual meeting, also at Chicago. Exposition management: International Exposition Co., 480 Lexington Ave., New York 17. ASHAE headquarters: 62 Worth St., New York 13.

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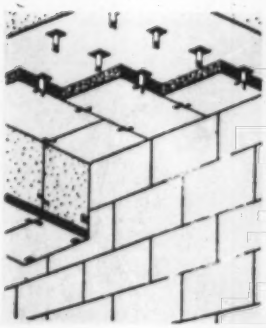

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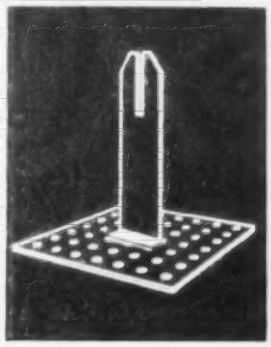

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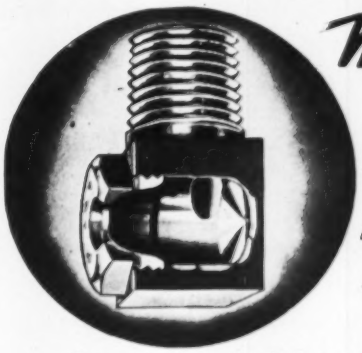

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These are "non-clogging" nozzles with a single large tangential lead hole to the swirl chamber that will never clog from any impurities small enough to pass through the orifice. Swirl chamber is conical on both ends and pivots liquid like a top to produce an exceptionally fine, evenly distributed, balanced spray of about 80° included angle. Wider spray angles up to 150° can be furnished to order.

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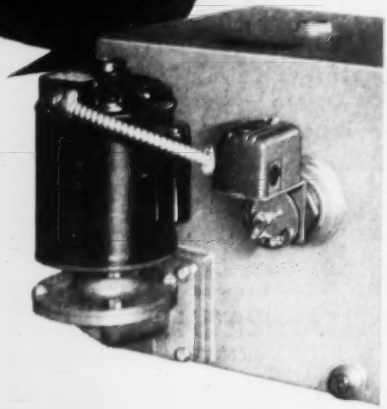
CONDENSATE PUMPS

designed and engineered to fit the exacting need of...

CONDENSATE RETURN

1 4100 SERIES PUMP
Heavy gauge, durable steel tank. 4200 Series, rugged cast iron tank for use where unusual water conditions are encountered. Same operating features.



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Capacitor type, vertically mounted, dynamically balanced, permanently lubricated, and with automatic thermal overload on single phase. Also built with 3-phase motor.

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Large capacity tank for ample condensate storage in minimum of floor space. Low inlet. Over-all simplicity.

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Specially designed to keep condensate from pump shaft, and for maximum performance without motor overload.

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Motor and impeller can be easily removed *without* disturbing piping . . . only 4 bolts to remove, no special tools required.

6 ROTARY SEAL
Oversize heavy duty construction. Located on impeller hub to keep condensate from pump shaft. This is a distinctive Sterlco advantage.

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American Standard Cast-Brass Solder-Joint Drainage Fittings, B16. 23-1955—21 pp. Published by the American Society of Mechanical Engineers. Available from the American Standards Association, 70 E. 45th St., New York 17. $1.25.

Proceedings of the Ninth Congress of Refrigeration—1300 pp. Institut International Du Froid, 177, Boulevard Malesherbes, Paris-17e.

American Institute of Plant Engineers Directory for 1956—66 pp. American Institute of Plant Engineers, Room 620, Westminster Bldg., Chicago 3, Ill. $5.00.

Handbook of Engineering Materials—By Douglas F. Miner and John B. Seastone. 1382 pp. John Wiley & Sons, Inc., 440 Fourth Ave., New York 16. $17.50.

Commercial and International Developments in Atomic Energy—Proceedings of a forum meeting. 598 pp. Atomic Industrial Forum, Inc., 260 Madison Ave., New York 16. $8.50.

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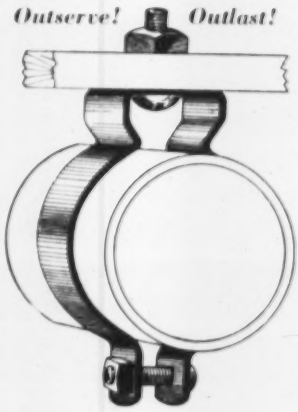

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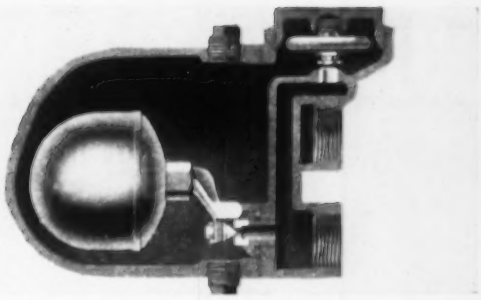

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WATER-COOLING TOWERS FOR USE WITH AIR-CONDITIONING AND REFRIGERATION EQUIPMENT—ARI Standard 910-55. Air-Conditioning and Refrigeration Institute, 1319 Connecticut Ave., N. W., Washington, D. C. Free.

RIGID POLYVINYL CHLORIDE SHEETS—Commercial Standard CS201-55. 11 pp. Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. 10c.

ASTM STANDARDS, 1955 EDITION—Issued individually in parts. Part 1, Ferrous Metals ($13.50); Part 2, Non-Ferrous Metals ($11.00); Part 5, Fuels, Petroleum, Aromatic Hydrocarbons, and Engine Antifreezes ($11.00); Part 6, Electrical Insulation, Electronic Materials, Plastics and Rubber ($13.00). American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa.

PROBLEMS AND CONTROL OF AIR POLLUTION—270 pp. F. S. Mallette, Ed., Reinhold Publishing Corp., New York, N.Y. $7.50.

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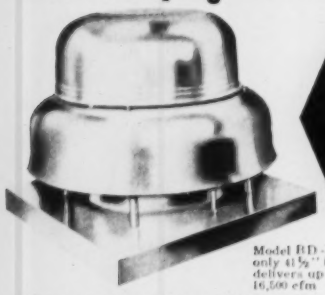

New COOK all-aluminum belt-drive centrifugal ventilator

Model BD-43 is only 41½" high, delivers up to 16,500 cfm

- Saves up to 400 lbs. on large models
- Only 6" high roof curb required
- Weatherproof aluminum shell and base
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- Compact belt-drive
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- Non-overloading wheel, low tip speeds
- Rubber-mounted drive assembly
- From 1,000 to 16,500 cfm

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EASY TO CLEAN. Remove four bolts and shell lifts off.

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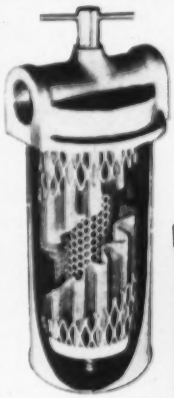

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Balanced Synclinal Design means longer periods of efficient filtration and productive operation.

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to withstand use under rugged conditions, yet simple enough to allow any workman to easily disassemble, clean and reassemble on the spot, in a matter of minutes.

A SIZE FOR EVERY NEED

Available in line and sump type units in capacities from 5 to 100 G.P.M. Permanent type Monel metal insert ranging in mesh sizes from coarse 30 to fine 200.

Complete data and further information are contained in WATER CATALOG #301.

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IMMEDIATE DELIVERY!

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(C) Harmonious design

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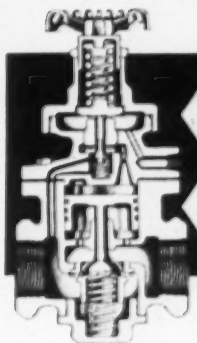

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for positive response
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for accurate regulation

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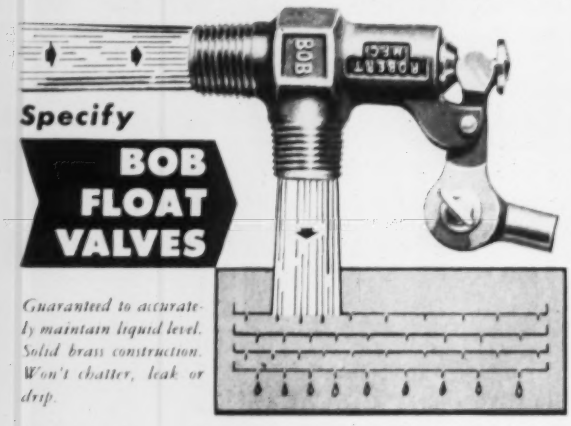
The Standard Valve
For COOLING TOWER applications . . .



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Guaranteed to accurately maintain liquid level. Solid brass construction. Won't chatter, leak or drip.

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PRESENT STATUS OF SCHOOL HEALTH VENTILATION—Reprinted from American Journal of Public Health, Vol. 46, No. 2, February, 1956. By C. P. Yaglou. 7 pp. American Public Health Association, Inc., 1790 Broadway, New York, N.Y.

CONSTRUCTION PLANNING, EQUIPMENT AND METHODS—R. L. Peurifoy. 534 pp. McGraw-Hill Book Company, Inc., 330 W. 42nd St., New York 36. $8.50.

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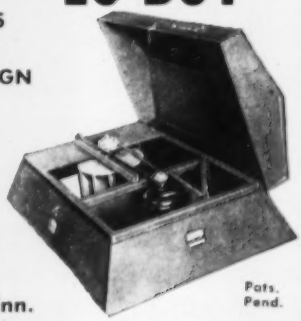

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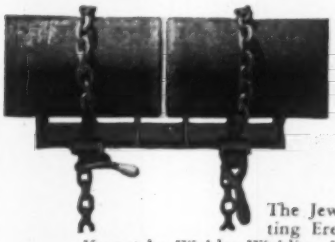

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Users Have Named
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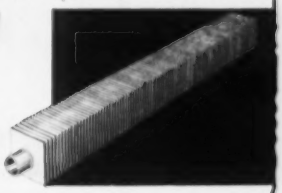

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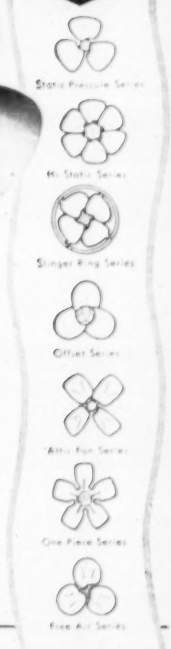

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...in main condensers
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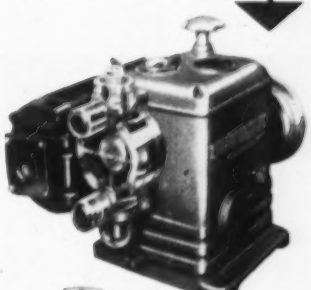

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division of
BIF B-I-F INDUSTRIES
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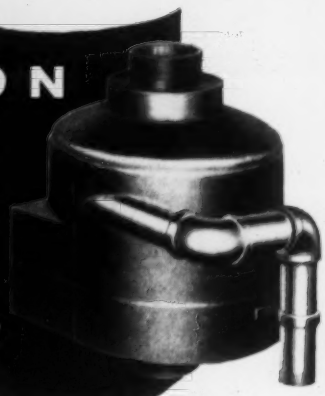
WILSON
CENTRIFUGAL
BLOWDOWN
SEPARATORS

Write for Bulletin 30. Gives complete details and simple installation diagrams.



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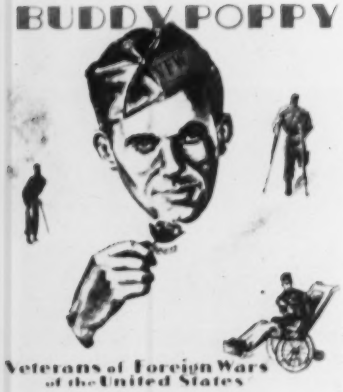
Bachelor and Master of the Science of Architectural Engineering Degrees from the University of Minnesota. During 5 years with the American Radiator and Standard Sanitary Corp. records will show that I led the entire country in all sales and sales contests for 5 consecutive years. At present I have a non-specialized retail store which will be sold shortly. I am interested particularly in sales of heating, ventilating, air conditioning and refrigeration equipment in this area composed of Wisconsin, Minnesota, Iowa, Illinois and Michigan; new developments in the industry primarily. Can conduct sales meetings and conferences in an interesting and promotional manner. Address correspondence A. E. Swanstrom, 117 North Adams St., Green Bay, Wisconsin.

Wear a
BUDDY POPPY



Veterans of Foreign Wars of the United States

for sale . . .

Servel DUT steam actuated absorption unit; 25 ton capacity with matching Marlo CT-40 cooling tower; used 5 years; available approx. June 1; add cooling to that small auditorium now. Address Key 1247A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

1 — New 9 S 55 National Radiator Steam Boiler — 3120 AGA Sq. Ft. Rating — 936,000 Btu/hr. gas input — Gross output. — $697.25 each. M & V Supply Company, 1005 West Reno, Oklahoma City 4, Okla.

miscellaneous . . .

IDENTIFICATION
NAME PLATES

For Electrical Controls, etc. Machine Engraved on black surface plastic or on black anodized hard aluminum alloy. Valve Tags, Operating Data Plates, Municipal Approved Plates, etc. Quick service by mail. Send for free sample and prices. Or send your specifications for quotation. G. F. BUNNELL CO., 58 Ocean Ave., Amityville, New York.

agents wanted . . .

REPRESENTATIVES WANTED
Leading Eastern manufacturer of nationally advertised Commercial Finned-Tube and Baseboard Radiation offers the most extensive line in the industry to qualified representatives. Revised marketing program has created additional openings. Representatives must presently handle related heating items and include in coverage jobbers, contractors, engineers and architects. The quality and superior features of this line coupled with competitive pricing present an unusually profitable arrangement for the right men. Reply in detail stating present lines, territory, other pertinent data. Replies confidential. Address Key 1248A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

situations open . . .

ENGINEERING
OPPORTUNITY
WITH YOUNG GROWING
MIDWESTERN COMPANY
LIBERAL STARTING SALARY,
EXCELLENT
ADVANCEMENT POSSIBILITIES
PROFIT SHARING—RETIREMENT PLAN
CONGENIAL SURROUNDINGS
IN A NEW MODERN
AIR CONDITIONED PLANT.

Young Engineer with experience in oil burner design and service. Commercial and industrial experience desirable but not required. Basic duties consist of fuel nozzle design and application.

Write giving full resume of college work, experience and references.

Address reply to

M. E. O. Olson, Chief Engineer
DELAVAN MANUFACTURING CO.
West Des Moines, Iowa

AIR CONDITIONING man experienced in calculating and estimating year-round air conditioning for a large national plumbing and heating concern located in Central Ohio. State experience and all particulars. Good salary and opportunity. Address Key 1252A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

ENGINEERS, DESIGNERS, DRAFTSMEN. Minimum 5 years' experience. Openings in heating, air conditioning, plumbing, lighting and power. Permanent positions in Hartford, Connecticut. Qualified men will be considered for Department Heads. Salary commensurate with experience. Submit complete resume of education and experience, availability, desired starting salary. Fred S. Dubin Associates, Consulting Engineers, 178 South Whitney Street, Hartford, Connecticut. ADams 5-9851.

Classified Advertising

Rates for classified advertising are 15 cents for each word, including heading and address. One inch $7.00. Count nine words for keyed address. Minimum $2.50. Closing date 10th of the month preceding publication.

situations open . . .

APPLICATION ENGINEER

Challenging opportunity for mechanical engineer with five or more years experience in the design of air conditioning and refrigeration systems. Some of this experience must be in high pressure systems.

Work with consulting engineers and large accounts in setting up specifications for air conditioning systems. Also compile design information on various systems, gather control and wiring information for air conditioning and refrigeration products, and assist in the preparation of bulletins and articles on system application engineering. Travel required.

This is a position with a rapidly growing company — a leader in the air conditioning field. Send detailed resume of experience to Manager of Staff Employment, The Trane Company, La Crosse, Wisconsin.

FIBRE GLASS INSULATION

Salesman desired by distributor and fabricator of nationally advertised line in the Metropolitan New York area including Westchester, Nassau and Suffolk Counties.

We prefer a man who is familiar with some or all of the following types of firms — air conditioning, sheet metal, warm air heating, refrigeration, piping and insulation contractors. Commission and drawing account can be arranged. Address Key 1245A, Heating, Piping and Air Conditioning, 1734 Grand Central Terminal Bldg., New York 17, New York.

situation wanted . . .

SALES ENGINEER — Well known in the New England Automatic Equipment Field, as it pertains to Heavy & Light Oil equipment. 25 to 30 years experience, setting up wholesalers on this equipment for resale to the Trade. Know many of the Wholesalers on a personal basis. Prefer the New England & Northern New York State territory. Can supply full engineering & Field technical Service to the wholesalers & trade. Full versified on all types of Automatic Controls and their functions, etc. All replies treated in confidence; address replies to: "CECO" P. O. Box 64, Plainfield, Connecticut.

BUY U.S. SECURITY BONDS NOW!

situations open . . .

BRILLIANT OPPORTUNITY
for
SALES ENGINEER

35 to 45 years old with training and experience in Heating and Air Conditioning to promote, sell and supervise the most modern application of Radiant Heating, Radiant Cooling and Acoustical Treatment. Highly adaptable to all types of Commercial, Institutional and Industrial Buildings.

An exclusive in a protected territory with a well established organization. Please write for appointment and state qualifications. All applications completely confidential.

CINCINNATI FLOOR COMPANY, Inc.
Acoustical Department
4785 Eastern Ave., Cincinnati 26, Ohio

WANTED — TWO DISTRICT MANAGERS
One to be located in Metropolitan New York Area and one in San Francisco. To Supervise Sales Offices of prominent manufacturer of Heating, Cooling, & Air Conditioning equipment on East and West Coast areas. Send complete resume of education, experience and salary requirements to Key 1213A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

PIPING DESIGN & LAYOUT ENGINEER
HEATING & VENTILATING ENGINEER
Due to our expansion program, the above-mentioned permanent positions are available in a large pulp and paper manufacturing plant in the Upper Midwest. The individuals desired should be graduate engineers with a minimum of five to ten years experience who are well versed in their respective fields. Our employees know of these openings. Your confidential reply should include personal, educational and work history together with salary thinking. Write Key 1218A, Heating, Piping & Air Conditioning, 6 North Michigan Ave., Chicago 2, Ill.

Sheet Metal Estimator and Supervisor for fabrication and installation of commercial and industrial ventilation and air conditioning. Address Key 1244A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

agents wanted . . .

MANUFACTURERS' REPRESENTATIVE
Leading manufacturer of nationally advertised air diffuser requires representatives in the following areas:

Jacksonville, Florida
Tampa, Florida
Miami, Florida
Charlotte, North Carolina
Toledo, Ohio
Salt Lake City, Utah
San Diego, California

Address Key 1243A, Heating, Piping & Air Conditioning, 6 North Michigan Ave., Chicago 2, Ill.

AGENTS WANTED — The New York Incinerator Company, specialists in Municipal and Industrial incineration, are expanding to national representation. There are great opportunities for agents having knowledge of incineration and no current ties in the business. Many territories open. Write to New York Incinerator Co., Inc., 90 West Street, N. Y. 6, N. Y.

lines wanted . . .

Well established Manufacturers' Sales Agency covering Colorado, Wyoming and Western Nebraska, selling to plumbing and heating wholesalers with architect and engineer contacts desires one or two additional accounts. Wholesaler stock items only. Address Key 1246A, Heating, Piping & Air Conditioning, 6 North Michigan Ave., Chicago 2, Ill.

patents . . .

INVENTION RECORD and Patent Information Booklet free on request. Franklin W. Dargan, Registered Patent Agent, c/o Evergreen Farm, 12500 Meadowood Drive, Silver Spring, Maryland.

MECHANICAL ENGINEERS
UNLIMITED OPPORTUNITY WITH LINDE in LOW TEMPERATURE ENGINEERING

Projects involve practical design and development engineering in:

- **equipment design**
- **instrumentation and controls**
- **pilot plant design and operation**
- **process engineering**
- **fabricating techniques**
- **heat transfer**
- **fluid flow**
- **thermodynamics**
- **distillation**
- **stress analysis**

These projects are associated with the production and distribution of oxygen, nitrogen and argon as low temperature liquid or gases.

LOCATION: Our Tonawanda Laboratories in suburban Buffalo, New York — our largest research and development facilities.

B.S., M.S., Ph.D. graduates with up to 5 years experience are invited to investigate.

LINDE AIR PRODUCTS COMPANY

a division of

UNION CARBIDE AND CARBON CORPORATION

Send resumes to:

Mr. P. I. Emch, P. O. Box 44, Tonawanda, New York

Refer to ad: HPA-L

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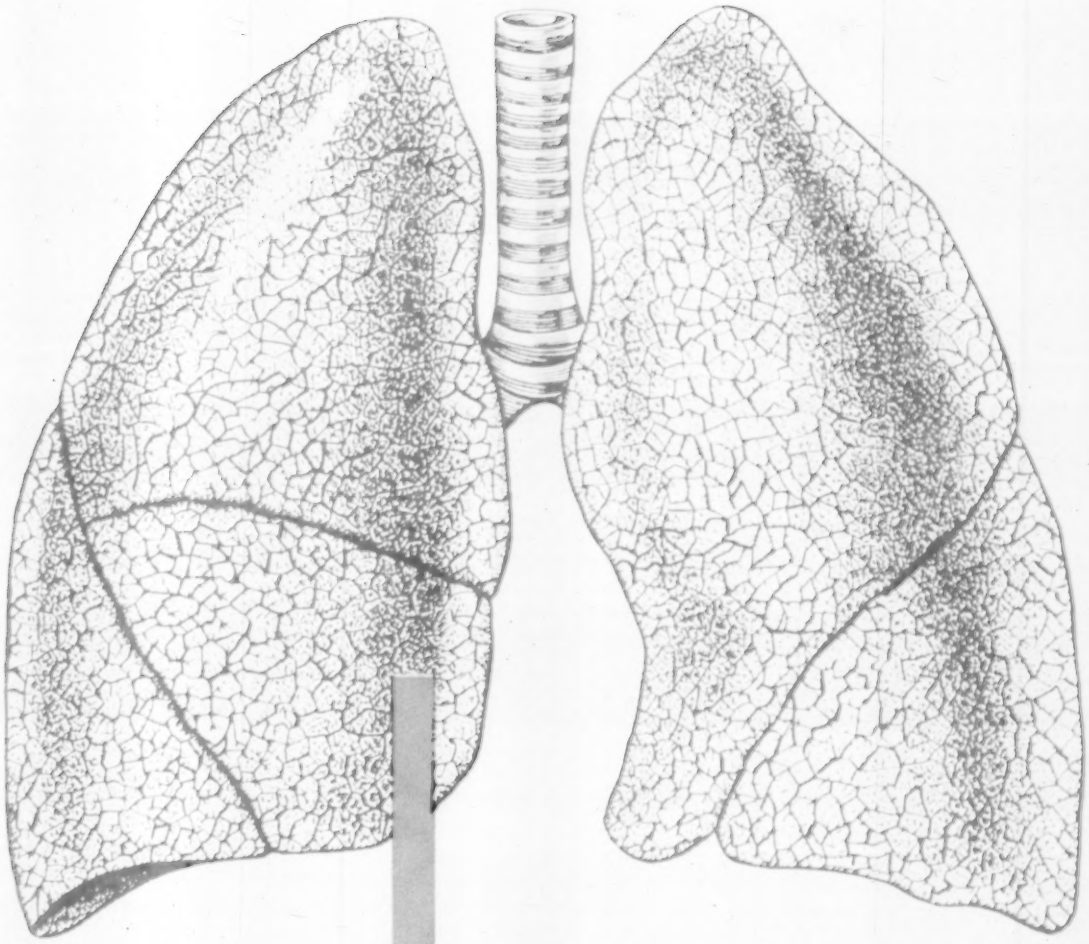
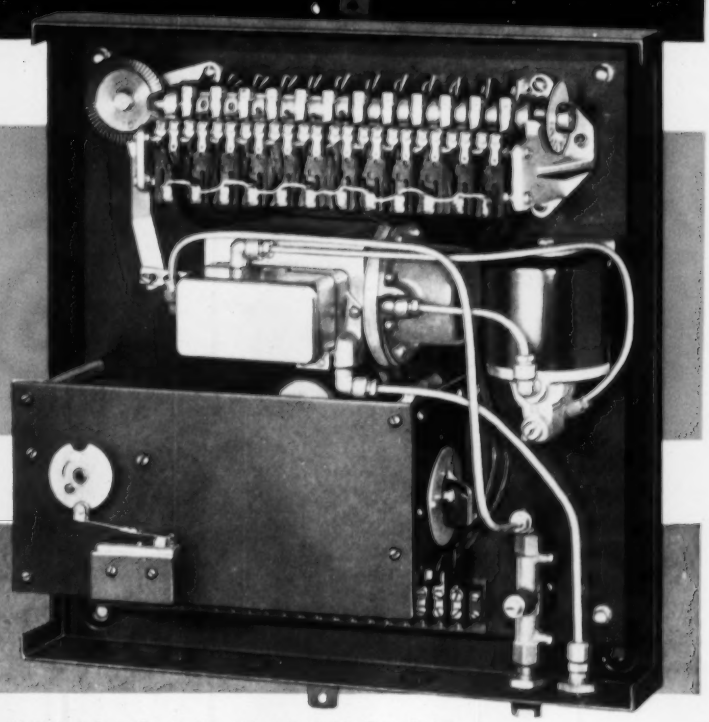


The only air handling equipment that is engineered and built better than the Clarage product.

CLARAGE FAN COMPANY
KALAMAZOO • MICHIGAN

REFRIGERATION CAPACITY CONTROL

JOHNSON Pneumatic Step Controller



- BALANCES CAPACITY WITH LOAD
- PREVENTS SHORT CYCLING
- EQUALIZES WEAR OF EQUIPMENT

12 Switch Step Controller with Adjustable Time Delay, Recycler Solenoid and Automatic Sequence Changer.

What It Does

This new and improved controller is designed to accomplish, with a single compact unit, everything that is desired for the control of multiple step refrigeration installations, including "on" and "off" operation of the steps in sequence, positive prevention of the starting of more than one compressor at a time after night shutdown or after current failure, and manual or automatic changing of compressor operating sequence to equalize wear. It can be used to control one or a group of refrigeration machines. It completely eliminates all the disadvantages of a series of separate pressure switches.

How It Works

The Johnson Pneumatic Step Controller, in response to changes in pressure from a controlling thermostat, actuates a number of separately adjustable, snap-acting, single-pole, double-throw switches in any desired sequence. Control arrangements include (1) starting and stopping two or more compressors in sequence, (2) operation of cylinder unloaders in sequence, or (3) a combination of (1) and (2).

Special Features

Recycler and Time Delay—Recycler Solenoid immediately returns all switches to their normal position on shutdown or current failure. Time Delay assures the proper interval between successive switch operations on start-up or when current is restored after failure.

Sequence Changer—Varies the starting sequence of compressors to equalize running time and wear. Step Controllers are furnished with either Manual or Automatic Sequence Changer.

Models—Choice of 4, 6, 8 and 12 switch units, with or without special features such as Recycler, Adjustable Time Delay and Sequence Changer.

* * *

Installation and operation of the Johnson Pneumatic Step Controller is both simple and inexpensive. A nearby Johnson engineer will gladly explain, without obligation, how it can best solve your special problems, or write today for full details.

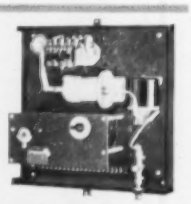
JOHNSON CONTROL

SINCE 1885

PLANNING • MANUFACTURING • INSTALLING

OTHER APPLICATIONS

Johnson Step Controllers are also used to control multiple fan or pump installations, electric heaters and other systems where electrically actuated devices are to be operated in sequence from a proportional acting pneumatic controller. Send the coupon for more facts.



JOHNSON SERVICE COMPANY
507-B East Michigan St., Milwaukee 1, Wis.

Please send me Apparatus Bulletin G-180 describing specifications, features and application of Johnson Pneumatic Step Controllers.

NAME

FIRM

ADDRESS

CITY & STATE